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TREATMENT OF FRACTURES

REPORTS

OF THE

COMMITTEE ON FRACTURES

OF THE

American Surgical Association

For 1913, 1914, 1915, 1916, 1917, 1918, 1921

EDITED BY

J. F. BINNIE, M.D., AND JOHN H. JOPSON, M.D.
Recorders of the Association

AND

JOHN B. ROBERTS, M.D., AND WILLIAM L. ESTES, M.D.
Chairmen of the Committee

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CONTENTS

	PAGE
1913 Report	1
1914 "	15
1915 "	21
1916 "	67
1917 "	69
1918 "	70
1921 "	75
Fractures in Military Service. By JOHN B. WALKER, M.D.	84
Simple Fractures of the Humerus. By THOMAS W. HUNTINGTON, M.D.	91
Fractures of the Bones of the Forearm. By EDWARD MARTIN, M.D., and E. L. ELIASON, M.D.	103
Fractures of the Tibia and Fibula. By ASTLEY P. C. ASHHURST, M.D.	112
Fractures of the Femur. By W. L. ESTES, M.D.	127

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American Surgical Association

RESOLUTION

Adopted May 31, 1912, at Montreal Meeting of American Surgical Association:

"*Resolved*, That the President (Dr. Arpad G. Gerster) appoint a Committee of Five to prepare a statement of the relative value of the operative and non-operative treatment of fractures of long bones (closed and open) to which shall be added an opinion as to the value of radiography in the determination of the choice of the method of treatment."

COMMITTEE FOR 1912, 1913, 1914

Dr. John B. Roberts

Dr. W. L. Estes
Dr. Thomas W. Huntington
Dr. John B. Walker
Dr. Edward Martin

COMMITTEE FOR 1915, 1916

Dr. W. L. Estes

Dr. John B. Walker
Dr. Edward Martin
Dr. Thomas W. Huntington
Dr. Astley P. C. Ashhurst

PREFACE

THE great interest in the treatment of fractures evoked by the visit in 1909 of Sir W. Arbuthnot Lane to the United States, reinforced in 1911 by an address on the same subject read before the American Surgical Association by its President Dr. Richard H. Harte, led to an important symposium at the meeting of the Association in 1912.

The formal papers on that occasion were presented by Drs. W. L. Estes, Howard Lilienthal, Edward Martin, John B. Walker, and Joseph Ransohoff. The other speakers were Drs. Charles L. Scudder, John B. Roberts, Thomas W. Huntington, M. H. Richardson, Otto Kiliani, F. B. Lund, A. T. Bristow, George E. Armstrong, Leonard Freeman, Charles L. Gibson, G. G. Davis, Richard H. Harte, Francis J. Shepherd, John H. Gibbon, Dudley P. Allen, L. L. McArthur, A. Vander Veer, S. J. Mixter, Willy Meyer, Arpad G. Gerster, Thorkild Rovsing, of Denmark, Robert G. LeConte, James E. Moore.

The divergence of opinion shown by the speakers convinced one of the Fellows of the desirability of obtaining, if possible, an authoritative opinion from the Association on what might be called a standard or routine method of dealing with the bulk of fractures of the long bones of the extremities. A formal opinion had been formulated and adopted by the Association in 1891[1] as to the results of treatment of fractures of the femoral shaft. A somewhat similar action was taken in 1900[2] when the *x*-rays became an adjunct in the diagnosis and treatment of bone injuries.

Accordingly the Resolution printed on a preceding page was presented on May 31, 1912, and adopted. At the time, the

[1] Transactions, Vol. IX, p. 81, and Minutes, 1891, p. 211.
[2] Transactions, Vol. XVIII, p. 461, and Minutes, 1900, p. 415.

mover of the Resolution did not know that the British Medical Association had a committee at work on a similar study.

The Report of that Committee was published in the *British Medical Journal*, November 30, 1912, while the Report of the American Surgical Association Committee for 1913 was still in preparation. Much valuable information was obtained by the American Committee from the members of the British Fracture Committee and from its published Report.

The Committee of the American Surgical Association presented its first preliminary report on May 6, 1913, at the Washington meeting. During the same meeting Dr. Ellsworth Eliot, Jr., read an important paper on "The Legal Responsibility to the Surgeon and Practitioner which the Use of the *X*-ray Involves." This communication gave rise to a suggestion that the Committee on Fractures take up the consideration of this phase of professional action in connection with the Treatment of Fractures.

Accordingly, the Committee issued in June, 1913, a letter to the Fellows asking aid in the study of the topics mentioned in its Report, and included a query as to medico-legal relations of radiography. The request stated that:

"To make the results of the investigation authoritative and worthy of the Association, it is necessary for the members of the Committee to have the co-operation of every Fellow. It seeks, therefore, memoranda on the following points:

1. The value of mobilization with light frictions (Lucas-Championnière) as a routine method of treatment.

2. The fixing of standards for the determination of the duration of absence from work necessitated by the required treatment of particular fractures, and of standards for determining the degree of permanent disability likely to accrue from the injury.

3. The value of abduction and the best method of its application in fractures of the upper end of the humerus.

4. The value of steady fixed extension (Robert Jones), compound pulley traction (Robert Jones), vertical traction (Thomas Bryant) in adults, and of nail extension (Steinmann) in fractures of the shaft of the femur.

5. The use of the Thomas knee splint in fractures of the shaft of the femur; the use of the abduction frame in fractures of the upper third of the femur; the value of forced abduction (Whitman) and of double traction (Maxwell) in fractures of the femoral neck.

6. The advantages and disadvantages of direct fixation of the fragments in open, so-called compound, fractures infected and non-infected.

7. The part that radiography should play in the diagnosis of fractures, and its medico-legal relation to fracture treatment in general.

If the Fellows will investigate these topics during the next six months, and report their results to the Fracture Committee, they will confer a favor upon its members.

Reports, reprints, statistics and conclusions should be sent to the Chairman of the Committee."

The information so received was to be used by the several sub-committees of the Committee in its Report for 1914.

Pressure of professional work prevented the carrying out of this plan in its entirety, and the Report of 1914 contained only a study of the sixth topic, which was prepared and read by Dr. William L. Estes, as a Preliminary Report on Compound Fractures.

At this date Dr. Roberts resigned as a member of the Committee because of illness and press of professional work and Dr. A. P. C. Ashhurst was appointed to fill the vacancy.

The Report presented in 1915 took up the subject with vigor and will be found of importance.

JOHN F. BINNIE,
Recorder.

REPORT OF 1913

COMMITTEE

Dr. William L. Estes
Dr. Thomas W. Huntington
Dr. John B. Walker
Dr. Edward Martin
Dr. John B. Roberts
Chairman

Synopsis. Topics considered. Conclusions in report of British Committee. Defects in conclusions of British Committee. Two methods of non-operative treatment: immobilization and mobilization. Mal-union and non-union not under discussion. Relative value of non-operative and operative treatment in closed fractures. Routine of treatment in: general practice; in small hospitals; in hands of experts. Need of fracture wards. Twelve queries for future study.

At the meeting of the Association held in Montreal last year there was adopted on May 31 a resolution that the President appoint a Committee to prepare a statement of the relative value of the Operative and the Non-operative Treatment of Fractures of the Long Bones; to which was to be added an opinion as to the value of radiography in the choice of the method of treatment. In the discussion stress was laid upon the fact that the Committee should consider open as well as closed fractures. It will be seen, therefore, that the duty assigned to the Committee involves the study of five topics. These are:

(*a*) The value of the treatment of recent closed fractures of the long bones of the extremities by non-operative methods, the value of the treatment of these lesions by operative fixation, and the relative worth of these opposed plans as a routine treatment.

(*b*) The value of operative and non-operative treatment of recent open fractures.

(*c*) The comparative usefulness of these two methods in treating vicious union and non-union of closed fractures.

(*d*) The part that radiography should play in the diagnosis of closed fractures and in the selection of the particular method to be used in treating the individual case.

(*e*) The determination of the proportion of patients which, after fracture of one of the long bones of the lower limb, is able to return to work without disability, and what method is most likely to insure such complete restoration of function.

Not until after adjournment of the meeting, at which the Committee was appointed, did its members realize the importance of the investigation assigned them. The gravity of the duty has been further emphasized by the publication on November 30, 1912, of the elaborate report of the Committee of the British Medical Association on the Treatment of Simple Fractures.

A study of the British report proves the necessity of a thorough examination of the therapeutics of fractures, and makes it imperative that the Committee of the American Surgical Association pursue the investigation in a manner creditable to American scientific spirit.

Your Committee has therefore determined to present at this time simply a preliminary report, and asks to be continued, so that it may consider in a thorough manner the five propositions committed to it.

The members of the British Medical Association Committee believe it possible to obtain a high percentage of good results in children under the age of fifteen years, by either non-operative or operative treatment in closed fractures of the shafts of the long bones, except in fractures of both bones of the forearm. They reached the conclusion also that the aggregate results of non-operative treatment in patients over fifteen years of age are not satisfactory, and that in persons beyond the age mentioned the deleterious influence of age upon the functional result is less marked when they are treated by immediate operation than if they are treated by non-operative methods.

In addition to these conclusions they express the opinion that the operative treatment of fractures requires such special skill

and experience and such facilities to prevent sepsis as makes it a method not to be undertaken except by those who have constant practice and experience in such surgical procedures. In their own words, "a considerable proportion of the failures of operative treatment are due to infection of the wound, a possibility which may occur even with the best technique." Their report states that the mortality directly due to the operative treatment of closed fractures, in skilled hands and in propitious surroundings, is so small that it cannot be urged as a sufficient reason against operative treatment. It admits, however, that "for surgeons and practitioners who are unable to avail themselves of the operative method, the non-operative procedures are likely to remain for some time yet the more safe and serviceable."

The British Committee points out further that the operative material available under its time limit was so small that it is undesirable to draw any final conclusions from its statistics as to the relative value of operative and non-operative treatment. It avers that the collection of facts relating to the non-operative treatment is a very large one and yields conclusions having a considerable degree of finality. It believes that at a later date future results of operative treatment could be analyzed on the same basis, and that thus the relative value of the non-operative and operative therapeusis of fractures could be finally ascertained.

It seems to your Committee that the main defects in the very valuable investigation of the British Committee lies in the fact that it apparently includes in the non-operative category all those recent closed fractures that had not been treated by incision and fixation of the fragments. It is pretty clear, therefore, that in the non-operative class are included some cases that not even the ardent advocates of operation would consider proper for operative treatment. Reference is made, of course, to fractures with coincident local complications, such as comminution of bone, injuries of skin, nerves, muscles, or bloodvessels, and luxation of joints, or accompanying general complications,

such as alcoholism, old age, or cardiovascular disease. These complicated fractures serve to lower markedly the percentage of good results in the non-operative class.

Another misleading agency in such a statistical inquiry is the varying degrees of skill everywhere recognizable in practitioners who undertake the treatment of broken bones. Many such lesions are, and ever must be, treated by doctors who lay no claim to special surgical skill or experience. The family physician, the young hospital officer, or the recent graduate in medicine takes care of a considerable number of recent fractures. These doctors usually cling to non-operative procedures.

Even if the 2000 or more non-operative cases examined by the Committee of the British Medical Association were all hospital cases in whose management the family doctor was not concerned, many must have had their fractures reduced and treated by doctors not equal to the surgical standards of those who essayed the treatment of the 200 or more operative cases. Yet at least a degree of comparison is made between the results of the non-operative (conservative) method and the operative (blood-shedding) method on this dissimilar basis.

It is true that the committee of our British colleagues utters a warning against making a comparison between the 200 plus operative and the 2000 plus non-operative cases examined. It, however, lays stress rather on the numerical difference than on the fact that the operative statistics refer almost entirely to selected cases under the care of surgical experts. The non-operative class bears, however, the burden of some fractures complicated with serious general and local lesions and of many fractures under the care of unskilled, indifferent, or incompetent practitioners. When any new system of treatment is on trial, an expert surgeon anxious to do well for his patient naturally selects his cases and gives them marked personal attention. These agencies play a telling role in the battle against morbidity and mortality.

It is to be regretted that the results obtained by the *two* chief methods of non-operative fracture treatment could not have been

separated for statistical study by the committee of the British Medical Association. It is also credible that a better showing would have appeared in the non-operative end-results if patients in the hands of experienced surgeons only had been examined. Had the complicated fractures been eliminated also it is probable that the percentage of good functional results would have been higher than 90.8 for children under fifteen years of age, and 45.4 for adults. The percentages probably would have equaled those for operative treatment which are given as 93.6 for children and 66.3 for adults. Indeed, it is not unlikely that the percentage of good functional and good anatomical restoration in non-operative cases would have surpassed the end-results in operative cases.

It is well known that there are two dissimilar methods of handling closed (simple) fractures, which have been thus grouped together unfortunately in the non-operative category. Patients treated by these unlike methods should be separated for statistical purposes; and due regard needs to be given to their respective ultimate results. Otherwise a true estimate of the value of the best non-operative means of treating closed fractures will not be scientifically established. It is only the best non-operative method that should be compared with an operative method used in selected cases at the hands of experts.

The two chief methods of non-operative management of fractures are:

1. Prolonged continuous immobilization of the seat of fracture and the adjacent joints by the external application of rigid splints or dressings. This may be called the "Immobilization" method. It is the one probably very generally employed in Great Britain. It is, therefore, perhaps the method chiefly concerned in the anatomical and functional results which have caused the distinguished Mr. Lane and his followers to urge a more general adoption of operative exposure and direct fixation of fragments in fractures of the limbs.

2. Immediate gentle massage or friction, relaxation of displacing muscles, with almost no fixation, and very early

mobilization of the neighboring joints. This may be called the "Mobilization" method. It has long been urged by Lucas-Championnière the celebrated French surgeon. This mobilization method is used by some British surgeons and by a good many French surgeons who have become convinced of its value. The writings of Lucas-Championnière have had for years a direct influence on the practice of at least one of the members of the American Committee making this report.

It is believed probable that in the United States neither the "Immobilization" nor the "Mobilization" method has been employed in full. Certainly some American surgeons do not practise prolonged continuous immobilization of the seat of fracture and the neighboring joints, but permit a considerable amount of passive and active mobility with frictions very early in the treatment of fractures. In the United States this intermediate method is probably much more frequently adopted in the treatment of fractures of the upper than of the lower extremity. The reason is that in American hospitals persons with fractures of the upper limb are largely ambulant, and therefore are treated in dispensary services under surgeons of greater surgical experience than medical house officers, to whom the details of treatment of fractures of the thigh and leg in hospital wards are often delegated.

In taking up the discussion of the value of non-operative and operative methods in handling simple fractures of the long bones it is essential to begin with an exact statement as to what should be included in the terms non-operative treatment and operative treatment. By non-operative treatment the reader will understand that the Committee means the treatment by (1) the "Immobilization" method, which consists, as has already been said, in prolonged continuous fixation by means of external splints or apparatus; (2) the "Mobilization" method with light massage and little, if any, fixation splints. The former of these methods was used even by the early Egyptians. The latter was introduced to modern practice by Lucas-Championnière. By the operative method this Committee desires to indicate

that treatment of recent fractures which consists in incising the soft parts, so as to disclose the seat of fracture and permit the application, if necessary, of plates, screws, or wire directly to the fragments for fixing them.

By these definitions it is seen that the treatment of malunion or non-union of fractures is not under discussion. In fact, the investigation is limited to those cases in which the seat of fracture is exposed to view for reposition of fragments practically within two weeks after receipt of injury. By this means are ruled out also those cases in which operative treatment has been adopted only after a recognized failure of non-operative methods. This failure may have been due to difficulty in maintaining coaptation of fragments, to deficient or faulty union or to absolute non-union. Obviously these delayed cases should not be put in the same category with cases submitted to immediate operative treatment within seven to fourteen days. In the same manner tenotomies, osteotomies, removal of callus or projecting fragments, freeing of nerves, excision of joints, the controlling of hemorrhage, the reducing of coincident dislocation, should be excepted from classification as a part of either non-operative or operative treatment, so far as the present inquiry is concerned. These subsidiary procedures are mere coincidences affecting at times both systems of treatment.

So far as is possible the investigation should determine the relative value of the two methods, namely, the non-operative and the operative, in closed fractures of the long bones of the limbs when circumstances are the same. The surgical attendant in each case should be equally skilled; the fracture identical in character and situation, and the patients similar in temperament, in environment, and in social and financial standing. Diagnosis in both forms of treatment should be made with the *x*-rays and immediate reduction attempted under anesthesia, and the method of treatment then selected. After a few days the correctness of the reduction should be confirmed by *x*-rays, and attention given to active and passive motion of the joints to prevent stiffness occurring as the result of traumatic arthritis,

which often happens in fractures as it does in sprains. Prolonged abstinence from weight-bearing must be insisted upon in fractures of the bones of the lower limb.

It will be seen from these axioms that the determination of the exact value of any method of treatment, and especially of the comparative worth of divergent methods, can scarcely be reached even by the study of a large number of case reports. The conclusions of your Committee, therefore, are founded upon what experience a study of the recent literature and a careful reading of the statistics and conclusions of the Committee of the British Medical Association seem to justify.

The inquiry presents itself in the form of three questions:

1. What should be the routine method for the average general practitioner and those unskilled in surgery as a specialty?

2. What should be the routine treatment for trained surgeons with the usual facilities afforded by small or "cottage" hospitals?

3. What should be the routine treatment for skilled surgical experts with adequate hospital facilities?

For all three classes of medical attendants the Committee believes that *prolonged* immobilization with *continuous* fixation by means of external splints or apparatus should be abandoned. This ancient method frequently leads to bad anatomical and bad functional results. The evil sequels may be caused by concealment of imperfect reduction or by overlooked later deformity from imperfect maintenance of coaptation of fragments. Ankylosis of joints may arise from unrecognized coincident traumatic arthritis or from prolonged immobility of proximal joints. Pressure sores, ischemic palsy, or gangrene may follow the omission of frequent examination of an exposed limb. This method fortunately has long been abandoned by the surgical expert. Some surgeons and medical attendants mentioned in the first class may not yet have replaced the immobilization method by more modern procedures.

What then shall be the method recommended for each of the three classes of practitioners mentioned?

A. For the first class, which includes all those not trained in surgery as a specialty, the Committee suggests the study and adoption of a routine method midway between that of immobilization, on the one hand, and the mobilization of Lucas-Championnière or the traction method of Bardenheuer on the other. It is believed that both the method of the French surgeon mentioned and that of Bardenheuer, the German expert, probably will be found to require too much skill, experience, and attention to be safe in the hands of those who only occasionally have need to treat the more troublesome fractures. For these, general anesthesia should nearly always be employed for the diagnosis and reduction of the fracture, unless *x*-rays are used during the manipulation preceding the application of the fracture dressing. General anesthesia should always be used by such practitioners in the diagnosis and reduction of fractures involving joints. It alone will solve many difficulties of diagnosis and often simplify the subsequent treatment of the injury.

If reliance is placed upon *x*-ray readings, the study of the skiagraphic plate must be under the direct supervision of a medical man accustomed to both clinical and radiographic examination of bone lesions. The radiographic reports of even expert radiographers alone are not always reliable guides to surgical practice. They must, as other pathological reports, be studied in association with expert surgical experience and clinical observation.

The maintenance of reduction of the fragments should be assured by position, traction, splints, or other easily removable and adjustable apparatus. Splints should be so arranged as to allow easy and frequent inspection of the condition of the fragments and soft parts, and to permit early passive and slight active movements. Molded splints of gauze and gypsum or other plastic materials fit well and best fulfil the above requirements. The watchwords for this first class of practitioners are general anesthesia, plastic splints or traction, frictions and frequent inspection, early mobility, delay in weight-bearing.

B. What should be the routine for the second class, viz.,

trained surgeons restricted by the moderate facilities of small or cottage hospitals?

Prolonged immobilization has probably been largely discarded already by most American surgeons, when they take personal care of the entire treatment of a fracture. This is especially true of patients in private practice. Mobilization, less than that advised by Lucas-Championnière, or traction apparatus, to a less extent than that used by Bardenheuer, varying with the locality of the injury, has been adopted by many and probably should be adopted by all such surgeons for the usual run of fractures. One or the other method will probably continue to be the routine at the hands of the class of surgeons mentioned in private practice and in small hospitals with moderate facilities.

This opinion suggests, it will be observed, that the operative treatment be restricted to especially rebellious fractures known to be such or found to be such after a very few days' study. This judgment is recorded because of the difficulty under many circumstances of insuring perfect asepsis and sufficient trained assistance.

The troublesome fractures that may with propriety be mentioned as probable candidates for operative treatment are:

Fractures of the surgical neck of the humerus, T-fractures at the lower end of the humerus, fractures of the upper third of the radius, fractures of the upper third of the radius with dislocation of the radial head, fractures of the radius and ulna in the shafts, especially in adults, fractures of the upper third of the femur, supracondyloid fractures of the femur, fractures of the tibia and fibula near the ankle occasionally. In a general way it may be said that operative treatment suggests itself as the preferable method in any fracture, which cannot be properly reduced, or satisfactorily retained after reduction.

If operative treatment be selected, the metal plate under absolute asepsis is the final resource, unless open reduction alone, or sutures, nails, or screws be effective. When reduction of fragments is not easily gained or its maintenance is doubtful, plating will be usually found better than wiring. A few cases

will not need direct fixation after the reduction has been accomplished through the incision. The operation should be immediate, that is, within a week or ten days, after the receipt of injury. It is, in fact, better to operate within a few hours than to delay even a few days, unless shock or other contra-indication requires delay. The method selected by the surgeon within the first week should, as a rule, be continued, if the surgeon be familiar with both operative and non-operative procedures.

C. What should be the routine treatment for the third class, viz., skilled surgical experts with adequate hospital facilities?

If prolonged immobilization has not been discarded, the surgeon can hardly be termed a skilled surgical expert in fracture treatment. He is behind the times in the surgery of fractures, though he be a recognized expert in abdominal, cerebral, thoracic, or pelvic surgery, or other branches of the medical art. To a fracture specialist with the facilities, a sufficient number of trained assistants, and the other essentials of a well-organized, modern hospital, it makes little real difference in morbidity or mortality whether he selects the non-operative or the operative plan. The latter, like all aseptic surgical procedures, requires more time, more care and more conscientious service at the beginning but makes the after-days easier for the surgeon, less painful for the patient, and less troublesome for the nurses. These surgeons may at times gain great advantage from the use of the fluoroscope, while adjustment is in progress.

The time must soon come when metropolitan hospitals will not be considered satisfactorily organized unless fractures are assigned for treatment to specially equipped wards under the care of surgeons particularly interested in the pathology and treatment of these injuries. Gunstock deformities of the elbow, forearms incapable of full pronation and supination, deformed wrists, valgus ankles, coxæ varæ, and shortened and crooked femurs all too frequently prove the need for increased surgical skill, perhaps specialism, in the treatment of fractures of the tubular bones of the extremities.

It is probable, though not certain, that consolidation of a fracture takes place a little more slowly after direct fixation of fragments with a metal plate than in a well-reduced fracture under non-operative treatment. The statement that the surgical expert will be able to conduct in safety the patient to the point of recovery with good result in most fractures by either the operative or the non-operative route is only true, provided he personally dominates the situation as to reduction, fixation and after-treatment, and sets the time at which the patient shall be allowed to resume his original occupation.

Such a surgeon, if of a mechanical turn of mind, will obtain good anatomical and good functional results in many fractures without blood-letting measures. In others he will not fail to recognize early the need for open reduction and direct fixation, nor will he fear sepsis, hemorrhage or shock. Similarly, he will seldom fail to recognize those cases in which these risks of operation outweigh the benefits likely to be obtained through it. Then some of his patients will be treated by non-operative methods and may perhaps show poor anatomical restoration of the skeleton, as well as bad functional use of the injured limb. They will, however, live.

If, on the other hand, this expert have more liking for operative surgery and a mind less mechanical in its attitude toward fracture repair, he will apply operative procedures to a greater number of fractures than will his colleague above mentioned. He will, however, equally recognize those cases in which operative surgery of the blood-letting kind has no place.

There are certain investigations which the Committee desires the Fellows of the Association, if they feel disposed, to pursue during the next ten months. Succinct reports of the results of these inquiries could then be placed at the disposal of this Committee to aid in the preparation of a more complete report on the topic incompletely considered at this time. They are:

1. The effect of immediate efficient reduction under general anesthesia with and without the coincident use of *x*-rays.

This is especially desirable in fractures of the lower end of the radius, lower end of the humerus, upper end of the humerus,

lower end of the tibia and fibula, lower end of the femur and neck of the femur.

2. Mobilization with light frictions (Lucas-Championnière) in all fractures.

3. Molded splints, not circular encasements of gypsum, for routine use immediately after reduction.

4. Increasing the usual time of convalescence for consolidation in fractures of the weight-bearing bones of the lower limb.

5. Fixing standards for the determination of the probable period of absence from work demanded by required treatment, and of the degree of partial or total permanent disability likely to accrue from particular fractures.

This inquiry is important, because time of absence from work and period of convalescence are not convertible terms. Temperament, kind of previous work, attitude of the employer, hope of legal recovery of damages, as well as the personal equation of the surgeon, are important incidents in establishing the period of treatment and the degree of disability.

6. The worth of the straight dorsal splint or the plastic palmar splint in fractures of the lower end of the radius.

7. The value of abduction in certain fractures of the upper end of the humerus.

8. The value of *heavy* weight traction (Buck), of steady fixed or rigid extension (Jones), of compound pulley traction (Jones), of vertical traction (Bryant) in adults, and of nail extension (Steinmann) for fractures of the femoral shaft.

9. The use of the Thomas knee splint in fractures of the shaft of the femur (Jones).

10. The use of the abduction frame in fractures of the upper third of the femur (Jones).

11. The value of forced abduction in fractures of the femoral neck (Whitman).

12. The use of double traction in fractures of the femoral neck (Maxwell).

The importance of settling the points raised by these inquiries, of gaining acceptance of average standards of efficient fracture

treatment, of furnishing railroad surgeons, accident insurance examiners, and judicial tribunals the results of the deliberate judgment of this Association, and of advancing the practice of the surgical art for the public benefit and for scientific truth impels your Committee to respectfully ask that it be permitted to continue the investigation which, under the authority of the Association, it has had the honor to begin.

All of which is respectfully submitted.

REPORT OF 1914

By DR. W. L. ESTES

Synopsis. Treatment of compound (open) fractures; personal statistics; results of treatment.

The almost insuperable difficulty of obtaining reliable and full data from the profession has compelled the reporter to compile from his own clinic at St. Luke's Hospital the cases herewith presented.

These cases are taken from the records of the last five years and represent the cases which could possibly be traced and the final results definitely determined.

As they are the product of only one hospital they cannot be taken and are not offered as fully representative of the methods and results of the profession, generally, in the United States. This is therefore but a contribution to the fuller investigation, which it is hoped will be presented at a subsequent meeting of the Association. Fifty-one cases are analyzed. They represent the following classes:

Compound fracture of the femur	8	cases
Compound fracture of both bones of the leg	15	"
Compound fracture of the tibia	10	"
Compound fracture of the patella	2	"
Compound fracture of the metatarsal bones	2	"
Compound fracture of the humerus	4	"
Compound fracture of both bones of the forearm	7	"
Compound fracture of the radius	1	"
Compound fracture of the ulna	1	"
Compound fracture of the humerus, radius and ulna	1	"
Total	51	"

28 cases were plated
7 " were wired
} Direct fixation of the fragments.

35 " had direct fixation of the fragments.
13 " were treated with external fixation only.
3 " were moribund when admitted and died within a few hours after admission. (No special treatment and not enumerated further.)

The plated cases were as follows:

Compound fracture of the femur	7	cases
Compound fracture of both bones of the leg	12	"
Compound fracture of the tibia	5	"
Compound fracture of the humerus	4	"

The wired cases were as follows:

Compound fracture of both bones of the leg	2	cases
Compound fraeture of both bones of the forearm	3	"
Compound fracture of the humerus and both bones of the forearm	1	"
Compound fracture of the patella	1	"
Total	7	"

The external fixation apparatus was practically the same in all cases, namely, a reinforced gypsum splint carefully molded over a thick dressing of sterile gauze and cotton-wool.

Average length of confinement in bed:

Forearm cases	6	days
Humerus cases	11	"
Leg cases	28	"
Femur cases	38	"

Average time in the hospital:

Forearm cases	23	days
Humerus	48	"
Leg cases	53	"
Femur cases	69	"

The average length of time the patient was out from work, that is, until he returned to his occupation:

Leg cases	6	months
Femur cases	13	"

For the upper extremity fractures the time of disability has not yet been thoroughly worked out; it seems to be about four months.

All the cases, but three, who had direct fixation were operated within forty-eight hours.

Two cases of compound fracture of both bones of the legs were plated on the fifteenth and eighteenth day after injury respectively, because the fragments could not be kept in place.

The case of compound fracture of the humerus and both bones of the forearm was wired on the tenth day after injury, also because by other means the fragments could not be kept in apposition.

Though compound fractures should always be regarded as infected wounds, it is noteworthy that it is recorded of these cases that but two which were fixed by direct applications to the bones suppurated.

One compound fracture of the femur, plated, had a streptococcic infection, but made a good recovery.

One compound fracture of the humerus, radius, and ulna suppurated from a mixed infection but also made a good recovery.

Not one of the direct fixation cases died.

Results. Of the forty-eight cases treated, there were two deaths, both from septicemia. One case, a compound comminuted fracture of the femur with very extensive injuries to the soft tissues, should have been amputated, but the patient refused amputation and died on the fourth day from acute sepsis.

The other case was a prolonged septicemia from mixed infection in a man who had a compound fracture of both bones of the leg, for which no direct fixation was done.

Mortality, 4.16 per cent.

One case of compound comminuted fracture of the bones of the leg with dislocation of the ankle-joint had a mixed infection, destruction of the joint and tarsus followed; an amputation was necessary.

Of the forty-six cases who left the hospital, all but one had useful limbs, that is to say, the one noted above which was amputated. 40.32 per cent. of these cases have returned to their former laborious occupations and report that they notice no disability.

Skiagrams are taken in cases of compound fractures:

1. After the first permanent dressing.
2. After the fixation plates have been removed.
3. When the union seems complete.
4. When the individual has returned to his occupation.

The number of cases is too small for any set conclusion in regard to the treatment of compound fractures, but certainly in this small series direct fixation has produced much the quicker recoveries, and far better results than the former conservative methods.

REPORT OF 1915

COMMITTEE

DR. W. L. ESTES

DR. JOHN B. WALKER — DR. THOMAS W. HUNTINGTON

DR. EDWARD MARTIN — DR. ASTLEY P. C. ASHHURST

1. Upper extremity.
   - (*a*) Humerus: 1. Neck; 2. Shaft; 3. Condyles
   - (*b*) Radius: 1. Extremities; 2. Shaft
   - (*c*) Ulna: 1. Extremities; 2. Shaft
   - (*d*) Both bones of forearm: 1. Shaft; 2. Colles

2. Lower extremity.
   - (*a*) Femur: 1. Neck; 2. Shaft: (*a*) Upper third; (*b*) Middle third; (*c*) Lower third
   - (*b*) Tibia: 1. Extremities; 2. Shaft
   - (*c*) Fibula: 1. Extremities; 2. Shaft
   - (*d*) Both bones of the leg: 1. Shaft; 2. Pott's

Compound fractures are studied under the same divisions and classification as are the simple ones.

The committee set itself the task of trying to determine especially three points:

1. To find out the average present-day results in both simple and compound fractures as regards anatomical and functional results in the several age groups, and the average time of disability. This latter period is determined to mean the average time the patient lost from work or his ordinary duties.

2. The comparative value of (*a*) the conservative or closed methods; (*b*) the operative or open methods.

3. The comparative value of immediate or delayed treatment in each group of cases.

In order to accomplish the collection and examination of cases a number of Fellows, surgeons in the various cities of the United States and Canada, were asked to serve as associate members of the committee. The following Fellows undertook the task of collecting and examining or having examined the end results of fractures in the hospitals of their respective cities:

Dr. M. L. Harris, Chicago, Illinois.
Dr. J. F. Buchanan, Pittsburgh, Pennsylvania.
Dr. R. Matas, New Orleans, Louisiana.
Dr. C. L. Scudder, Boston, Massachusetts.
Dr. A. F. Jonas, Omaha, Nebraska.
Dr. A. Primrose, Toronto, Canada.
Dr. A. MacLaren, St. Paul, Minnesota.

We wish gratefully to acknowledge their very great help in this work.

Also, the committee is indebted to Dr. W. E. Lee, Dr. Sergeant P. Martin, Dr. C. R. Steinke, and Dr. R. L. John, all of Philadelphia, for their efforts in collecting and examining cases and the free offering to the committee of the labor they had expended in personally examining and formulating the record of a large number of cases. The Committee wishes to give credit to these gentlemen and to offer them sincere thanks for their assistance.

The set of questions indicated by the accompanying blank form were used in collecting the data:

AMERICAN SURGICAL ASSOCIATION

Committee on Fractures

Committee

A. P. C. Ashhurst, M.D., Philadelphia
Edward Martin, M.D., Philadelphia
J. B. Walker, M.D., New York City
T. W. Huntington, M.D., San Francisco
W. L. Estes, M.D., Chairman, South Bethlehem, Penna.

Auxiliary Committee.

M. L. Harris, M.D., Chicago, Illinois
J. F. Buchanan, M.D., Pittsburgh
L. Freeman, M.D., Denver, Colorado
R. Matas, M.D., New Orleans
C. L. Scudder, M.D., Boston
J. E. Thompson, M.D., Galveston
A. F. Jonas, M.D., Omaha
J. F. Stokes, M.D., Washington, D.C.
A. Primrose, M.D., Toronto, Canada
A. Maclaren, M.D., St. Paul, Minn.

1. Patient's Initials.....Age.....Occupation.....
2. Cause of Fracture
   - Direct Violence.....
   - Indirect Violence.....
3. Bone Affected
   - Neck.....
   - Upper Third.....
   - Middle Third.....
   - Lower Third.....
   - Condyle.....
4. Kind of Fracture
   - Transverse.....
   - Oblique.....
   - Spiral.....
   - Comminuted.....
   - Simple.....
   - Compound.....
5. Method of Reduction and Treatment
   a. Anesthetic or not?.....
   b. Fixation.

Closed Method.	Open Method.
1. Splints....Kind.....	1. Immediate or delayed operation...
2. Plaster of Paris.....	2. Simply for reduction.....
3. Traction: Buck's.....	3. Plates.....Kind.....
Bardenheuer....	4. Wire.....
Steinmann.....	5. Nails.....
Jones.....	

6. Amount of Shortening.
    1. First dressings.....
    2. When all apparatus was removed.....
    3. When discharged from the hospital.....
    4. At latest observation.....
    5. State how measurements were taken.....
7. Was *X*-ray used?.....At what stage of treatment.....
    What did it show the position of fragments to be.....
8. Length of time in bed.....
9. Length of time crutches, canes, or other aids to walking were used.....
10. Length of time absent from work.....
11. Is patient able to take his former job?.....
12. Disability at last observation, estimated by:
    a. Deformity.....
    b. Endurance.....
    c. Pain.....
    d. Swelling.....
    e. Interference with joint function.....
13. Mortality.....
    a. Cause of death.....
    b. Location and kind of fracture.....
    c. Age of patient.....

The Committee collected 1745 cases: non-operative, 1358; operative, 387. There were 258 cases of the simple fractures operated on; and 129 cases of the compound. The results of all these cases have been carefully investigated.

Unfortunately the records of many of these cases were so incomplete they could not be used in their entirety.

These cases have been tabulated under six principal heads, viz.:

1. To show the results in the following age periods, viz.: (*a*) Under fifteen years; (*b*) 15 to 45 years; (*c*) 45 to 60 years; (*e*) over 60 years.

2. To show the effect of good anatomical restitution in shortening the period of disability and restoring full function.

3. To show the comparative results in the treatment of simple fractures of the operative (open) method and the non-operative (closed) method in the several age groups.

4. To show the result of the operative and non-operative methods in the treatment of compound fractures also considered as regards the several age groups.

5. To show the results of treatment of the fractures of the several long bones in the various regions, in the several age groups, in order to determine the average period of disability and to standardize the average recovery.

6. To show the comparative results of immediate and delayed treatment of the closed and open methods of treatment in the several age groups.

The operative cases are considered as

1. Immediate.
2. Delayed.

It was determined to class all operations performed within ten days after the injury under immediate operation, those done after this period are classed as delayed operations.

The results of operations for non-union and for deformities resulting from fractures are not included nor considered in the report at all.

The Committee finds:

1. The results are best in the age period under fifteen years. Conservative treatment is generally effectual during this period.

2. Good anatomical restitution of a fractured long bone always results in the best functional result, and has the shortest period of disability.

3. While few open operations are reported under the fifteen-year age period, it seems to make little difference in the result, except in senile cases (where it is unfavorable), what the age period is when the operation is done.

4. The end results of non-operative and operative treatment of compound fractures show very little difference in the anatomical result, but the functional results are better after operative treatment, except in compound fracture of the shafts of both bones of the leg; here the reverse seems to be true.

The age period except in senile cases has no marked effect on the result of the treatment.

5. The average period of disability (that is the time lost from work) in simple fractures, is as follows:

For fracture of the shaft of the humerus	14.0	weeks
For fracture at head and neck of the humerus	11.5	"
For fracture at condyles of the humerus	9.0	"
For fracture of the shaft of both bones of the forearm	10.8	"
For fracture of the femur, all sites	7.37	months
For fracture of the leg, all sites	4.75	"

NOTE.—This determination must still be held as not quite conclusive on account of the comparatively few clear reports on this point.

Periods of disability were not recorded accurately in many of the reported cases and very seldom in compound fractures. The reporter finds in his own compound cases (51 in number) the period of disability to be:

For fractures of the femur	13	months
For fractures of the leg	6	"
For fractures of the upper extremity	4	"

6. The humerus should show not more than 1 cm. shortening and no appreciable angulation. Musculospiral paralysis should not result.

The forearm bones should show no appreciable shortening, and pronation and supination should be unhindered. Function should always be good and no lasting pain result.

Fracture of the shaft of the femur should not result in shortening greater than 2 cm., nor in a fixed position of angulation or rotation which will affect the joints and require new habits of balancing or tilting of the pelvis; joint function should be good. No permanent disability of the affected member should result.

Fracture of the shaft of the bones of the leg should result in no appreciable shortening and no angulation or rotation. Joint function should be preserved.

7. There is no method or splint universally applicable, nor has any given splint or apparatus proved its superiority. All depends upon the discrimination of the surgeon and the manner in which the apparatus is applied and maintained.

It is evident that traction methods are most frequently unskilfully employed. *As a rule too little weight is used. The gauge of the proper weight required is that necessary to overcome the shortening.* This should be determined by careful daily

measurement. Traction methods require as a rule counter traction.

Plaster casts and moulded splints are especially indicated and useful after a fracture has been satisfactorily reduced.

Recommendations. 1. The Committee recommends as a general principle that fractures be treated by a skilled surgeon.

2. *X*-ray pictures should be made by a competent radiographer or a fluoroscope should be used for diagnostic purposes before the permanent dressing is applied. At least two skiagrams should be taken, and they should be taken from opposite perpendicular directions. Skiagrams should also be taken after permanent dressings are applied to prove proper reduction, and at the end of the treatment to show the results of the union and for the purpose of a graphic record.

3. Fractures should be reduced immediately after the injury if possible to obtain and apply proper retaining apparatus or splints. The statistics show markedly better results when the treatment is begun at once. It is, however, not only useless but cruel to subject the patient to the pain of manipulation for reduction unless the surgeon has proper fixation apparatus at hand and the patient is where he may have a permanent dressing applied.

4. General anesthesia should be employed, as a rule, to facilitate reduction and prevent pain unless the condition of the patient contra-indicates it.

5. Neither the non-operative nor the operative method is to be recommended exclusively. Each has its indication and should be employed when required. Generally speaking the age period under fifteen years is the period in which non-operative methods are especially effectual. In the other age periods up to sixty years, operative methods may with confidence be employed when non-operative treatment has proved ineffectual in reducing or controlling the fragments in proper position. The operation should not be delayed longer than one week after the injury.

6. The open method when adopted should be employed early. It may be used at any age period except in senile cases whenever

a skiagram shows a deformity or a position of the fragments which obviously cannot be reduced, or when proper efforts at reduction and retention have proved unavailing.

7. Some form of rigid plate applied directly to the bone or a bone "inlay" seems to be the best fixation method in operative cases.

8. Open operations for simple fractures should be undertaken only by experienced surgeons who are thoroughly equipped by training and who have proper instruments and apparatus to meet all the possible indications of the operation.

9. The work of this committee has been greatly hampered by the inadequacy of the records submitted for its consideration. A large proportion of the cases had to be rejected entirely, and most of them were so incomplete as to make deductions based upon them possibly misleading.

The first step in the betterment of practice is the study of results achieved by present-day methods. An adequate study is impossible without adequate records.

The committee strongly urges the American Surgical Association to set its seal of approval upon the standard form of record submitted by the committee,[1] and further to petition the American Medical Association to do the same. The committee also urges each member of this Association faithfully to keep these records in his practice and to see that they are kept in the hospitals to which he is attached.

The committee further recommends that a copy of the approved form be sent to all corporations within the United States of sufficient importance to have their own relief organizations or medical service, or both; to all accident insurance companies to be embodied and incorporated in the papers given to the insured, with the requirement that they be filled at the time of an accident involving fracture; to all hospital boards with the request that these records be made a part of the routine records of fracture patients, pointing out that thus not only are the hospital and its surgeons protected in case of litigation,

[1] See pages 27 and 28.

but that most valuable material is being collected to serve for attaining better results in the treatment of fractures.

EDWARD MARTIN
JOHN B. WALKER
T. W. HUNTINGTON
ASTLEY P. C. ASHHURST
W. L. ESTES
Chairman.

INQUIRY FORM FOR FRACTURES

General Results:	GOOD	MODERATE	BAD
Anatomical			
Functional			

1. Bone.....
2. Site—Neck.....Upper.....Middle.....Lower 3d.....Condyle.....
   Involving joint.....
3. Name.....
4. Sex—M.....F.....
5. Age.....
6. Occupation.....
7. Time fracture occurred—Date.....Hour.....
8. Hospital entered—Date.....Hour.....
9. First treatment—Date.....Hour.....
10. Cause of fracture.....
11. Kind of fracture—Oblique.....Transverse.....Spiral.....
    Impacted.....Comminuted.....Simple.....Compound.....
12. Was there serious injury to soft parts—Skin—Yes.....No.....
    Muscles—Yes.....No..... Vessels—Yes.....No.....
    Nerves—Yes.....No.....
13. Reduction: How many hours elapsed after accident before reduction?.....
14. Was anatomical reposition of fragments obtained? Yes.....No.....
15. Anesthetics used: Yes.....No.....Ether.....Gas.....

16. Fixation: Closed Method.
    Position—Hyperflexion.....full supination.....abduction.....
    Splints.....
    Plaster of Paris.....
    Traction—Buck's.....Jones.....Hodgen.....
    Bardenheuer.....Steinmann.....
    Amount of weight used.....

17. Open Method.
    Was non-operative treatment tried first.....
    How long after injury was operation performed.....
    Was open reduction alone performed.....
    What form of internal fixation used—Steel plates.....Wire.....
    Nails.....Screws.....Bone transplants.....
    Was it later necessary to remove fixation materials.....

18. Shortening at first examination.....cm.
    When all apparatus removed.....cm. Date.....
    When discharged from hospital.....cm. Date.....
    At last observation.....cm. Date.....

19. *X*-ray—Yes.....No.....First finding on the.....day before;.....
    on the.....day after reduction. Fragments Displaced—Slightly.....
    Markedly.....Fair apposition—Yes.....No..... Anatomical—
    Yes.....No..... Overriding.....cm. Rotation—Yes.....
    No..... At last finding on the.....day Overriding.....cm.
    Apposition Fair—Yes.....No..... Anatomical—Yes.....No.....

20. How long confined in bed?..... How long in hospital?.....

21. How long did patient use crutches?.....Cane?.....

22. Results—Final examination made.....weeks.....months after injury.
    Union bony.....fibrous.....Non-union.....

23. Disability—Partial.....Complete.....Estimated by
    deformity.....Shortening.....Angulation.....
    Swelling of soft parts.....Pain.....Nerve involvement.....
    Interference with joint function.....Endurance.....

24. Mortality—Age of patient.....Main cause of death.....

25. Duration of absence from work.....weeks.....months.....

26. Is patient fully able to take his former job?.....

27. Present wage-earning capacity compared with former.....

28. Compensation under insurance, legislative act or legal process obtained—
    Yes.....No..... Expected—Yes.....No.....

Simple Fractures

The following investigations (Tables I to XXIX inclusive) concern only *recent closed fractures.*

The questions to be answered by the tables are:

I. (*a*) Does a good anatomical result imply a good functional result? (Answer on p. 34.)

(*b*) Does a good anatomical result lessen the period of disability? (Answer on p. 44.)

II. Does operative treatment lessen the period of disability as compared with non-operative treatment? (Answer on p. 51.)

Included in the analysis are the following 829 individual cases of fracture:

TABLE I

	Total.	Non-operative.	Operative.
Humerus, upper end	30	15	15
Humerus, shaft	27	19	8
Humerus, lower end	69	56	13
Total	126	90	36
Radius, head	3	1	2
Radius, shaft	6	3	3
Radius, wrist (Colles's, etc.)	15	12	3
Ulna, olecranon	6	0	6
Ulna, shaft	4	1	3
Radius and ulna, shafts	77	53	24
Total	111	70	41
Femur, neck	69	63	6
Femur, trochanters	12	8	4
Femur, shaft	364	264	100
Femur, condyles	8	4	4
Total	453	339	114
Fibula, shaft	3	3	0
Tibia, shaft	24	17	7
Tibia and fibula, shafts	68	56	12
Tibia and fibula, ankle	15	15	0
Tibia, ankle	3	3	0
Fibula, ankle	26	26	0
Total	139	120	19
Grand total	829	619	210

A much larger number of reports was examined, but very many returns had to be rejected owing to insufficient data. Even among those acceptable, the groups in some instances are so small that it is useless to analyze them further. The only groups which approach a worthy number are:

	Cases.
1. The lower end of the humerus	69
2. The shafts of the radius and ulna	76
3. The neck of the femur	68
4. The shaft of the femur	364
5. The shafts of the tibia and fibula	92

It is only the fractures in these groups, therefore, that have been analyzed in any detail.

Definitions. The *anatomical result* denotes the position assumed by the fragments of bone at the time of consolidation. It has been estimated by (1) shortening, and (2) *x*-ray findings. It is on account of deficiencies in statements on these two points that very many reports were rejected. If any errors of interpretation have been committed it probably has been in recording as good anatomical results such as were really only moderately good anatomical results. We believe that a "good" anatomical result implies that "anatomical reposition" of the fragments was obtained before consolidation occurred. If such absolute anatomical reposition was not secured the anatomical result should be (and so far as possible has been) recorded as "moderate," even if eventually the bone ends became rounded off so that no palpable deformity remained when the patient was last examined. As regards *shortening*, only cases where no shortening was noted have been classed as good; if shortening of 2 cm. (three-fourths of an inch) or less existed, the anatomical result has been classed as moderate. All shortening of more than 2 cm. has been classed as a bad anatomical result. It is inconceivable that so much shortening should be present without either overlapping of the fragments, angulation, or loss of tissue.

Functional results are considered good only when no disability exists as to the part affected. If there is pain in damp weather, even though the patient resumes his former job, the function

is classed only as moderate. If the patient's earning capacity is notably diminished as a consequence of the fracture, the functional result is classed as bad; this may be the case, for instance, if a stiff but painless joint incapacitates a man. Again, the function of an individual joint or limb may be bad, without disabling its possessor; such a result is classed as moderate.

The functional result is known in a much larger number of cases than is the period of disability.

The anatomical and functional results in the whole series of cases may be seen in Table II. In Table III the same data are given for non-operative cases, and in Table IV for operative cases.

TABLE II.—FRACTURES OF THE LONG BONES

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
Good . . .	469 (57%)	397 (85%)	61 (13%)	11 (2%)
Moderate . .	251 (30%)	126 (50%)	98 (39%)	27 (10%)
Bad . . .	109 (13%)	22 (20%)	26 (24%)	51 (56%)
Total . .	829 (100%)	545 (65%)	185 (22%)	99 (12%)

TABLE III.—619 FRACTURES OF THE LONG BONES (NON-OPERATIVE)

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
Good . . .	318 (51%)	280 (88%)	32 (10%)	6 (2%)
Moderate . .	213 (34%)	118 (55%)	73 (34%)	22 (10%)
Bad . . .	88 (14%)	18 (20%)	20 (23%)	50 (57%)
Total . .	619 (100%)	416 (67%)	125 (20%)	78 (12%)

TABLE IV.—210 FRACTURES OF THE LONG BONES (OPERATIVE)

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
Good . . .	151 (72%)	117 (77%)	29 (19%)	5 (3%)
Moderate . .	38 (18%)	8 (21%)	25 (66%)	5 (13%)
Bad . . .	21 (10%)	4 (19%)	6 (28%)	11 (52%)
Total . .	210 (100%)	129 (61%)	60 (29%)	21 (10%)

The next interesting point is the influence of the age on the functional result:

TABLE V.—INFLUENCE OF AGE ON THE FUNCTIONAL RESULT

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
Under 15 years:				
Good . .	221 (70%)	209 (94%)	11 (5%)	1 (0.5%)
Moderate .	80 (25%)	63 (79%)	15 (18%)	2 (2%)
Bad . . .	17 (5%)	6 (35%)	3 (17%)	8 (47%)
Total . .	318	278 (87%)	29 (9%)	11 (3%)
15 to 45 years:				
Good . .	174 (56%)	136 (78%)	32 (18%)	6 (3%)
Moderate .	96 (31%)	41 (43%)	47 (49%)	8 (9%)
Bad . . .	41 (13%)	11 (27%)	12 (30%)	18 (43%)
Total . .	311	188 (60%)	91 (29%)	32 (10%)
45 to 60 years:				
Good . .	52 (41%)	39 (75%)	11 (21%)	2 (4%)
Moderate .	41 (32%)	13 (32%)	19 (46%)	9 (22%)
Bad . . .	33 (26%)	4 (12%)	7 (21%)	22 (67%)
Total . .	126	56 (44%)	37 (30%)	33 (26%)
Over 60 years:				
Good . .	22 (30%)	13 (60%)	7 (31%)	2 (9%)
Moderate .	34 (46%)	9 (26%)	17 (50%)	8 (23%)
Bad . . .	18 (24%)	1 (5%)	4 (22%)	13 (72%)
Total . .	74	23 (31%)	28 (38%)	23 (31%)
All over 15 years:				
Good . .	248 (49%)	188 (75%)	50 (20%)	10 (4%)
Moderate .	171 (33%)	63 (37%)	83 (48%)	25 (14%)
Bad . . .	92 (18%)	16 (17%)	23 (25%)	53 (57%)
Total . .	511	267 (52%)	156 (30%)	88 (17%)

TABLE VI.—INFLUENCE OF AGE ON NON-OPERATIVE TREATMENT

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
Under 15 years:				
Good . .	169 (66%)	161 (95%)	8 (5%)	0 (—)
Moderate .	73 (28%)	62 (85%)	9 (12%)	2 (3%)
Bad . . .	15 (5%)	6 (40%)	3 (20%)	6 (40%)
Total . .	257	229 (89%)	20 (7.7%)	8 (3%)
15 to 45 years:				
Good . .	90 (46%)	78 (87%)	10 (11%)	2 (2%)
Moderate .	75 (38%)	36 (48%)	34 (45%)	5 (6%)
Bad . . .	32 (16%)	8 (25%)	9 (28%)	15 (47%)
Total . .	197	122 (62%)	53 (27%)	22 (11%)

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
45 to 60 years:				
Good . .	43 (42%)	32 (74%)	9 (21%)	2 (4%)
Moderate .	33 (32%)	12 (36%)	14 (42%)	7 (21%)
Bad . . .	26 (25%)	4 (15%)	5 (19%)	17 (65%)
Total . .	102	48 (47%)	28 (27%)	26 (25%)
Over 60 years:				
Good . .	16 (25%)	9 (56%)	5 (31%)	2 (12%)
Moderate .	32 (50%)	8 (25%)	16 (50%)	8 (25%)
Bad . . .	15 (24%)	0 (—)	3 (20%)	12 (80%)
Total . .	63	17 (27%)	24 (38%)	22 (35%)
All over 15 years:				
Good . .	149 (41%)	119 (80%)	24 (16%)	6 (4%)
Moderate .	140 (38%)	56 (40%)	64 (45%)	20 (14%)
Bad . . .	73 (20%)	12 (19%)	17 (23%)	44 (60%)
Total . .	362	187 (52%)	105 (29%)	70 (19%)

TABLE VII.—INFLUENCE OF AGE ON OPERATIVE TREATMENT

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
Under 15 years:				
Good . .	52 (86%)	48 (92%)	3 (6%)	1 (2%)
Moderate .	7 (10%)	1 (15%)	6 (85%)	0 (—)
Bad . . .	2 (3%)	0	0	2 (100%)
Total . .	61	49 (82%)	9 (13%)	3 (5%)
15 to 45 years:				
Good . .	84 (74%)	58 (69%)	22 (26%)	4 (5%)
Moderate .	21 (18%)	5 (24%)	13 (62%)	3 (14%)
Bad . . .	9 (8%)	3 (33%)	3 (33%)	3 (33%)
Total . .	114	66 (58%)	38 (33%)	10 (8%)
45 to 60 years:				
Good . .	9 (37%)	7 (77%)	2 (22%)	0 (—)
Moderate .	8 (33%)	1 (12%)	5 (63%)	2 (25%)
Bad . . .	7 (30%)	0 (—)	2 (28%)	5 (71%)
Total . .	24	8 (33%)	9 (36%)	7 (30%)
Over 60 years:				
Good . .	6 (54%)	4 (66%)	2 (33%)	0 (—)
Moderate .	2 (18%)	1 (50%)	1 (50%)	0 (—)
Bad . . .	3 (27%)	1 (33%)	1 (33%)	1 (33%)
Total . .	11	6 (54%)	4 (37%)	1 (9%)
All over 15 years:				
Good . .	99 (67%)	69 (69%)	26 (37%)	4 (4%)
Moderate .	31 (20%)	7 (21%)	19 (62%)	5 (17%)
Bad . . .	19 (12%)	4 (17%)	6 (33%)	9 (50%)
Total . .	149	80 (53%)	51 (34%)	18 (12%)

Comments on Tables II, III, and IV. Table II gives the answer to the first part of Question 1. It shows without any doubt that the surest way to secure a good functional result is to obtain anatomical reposition of the fragments in any fracture: a good anatomical result gives a good functional result in 85 per cent. of cases; if anatomical reposition is not secured there is at once a falling off in good functional results to 50 per cent. This table shows also the apparent difficulty of obtaining such reposition, or at least the rarity with which it is actually obtained (only in 57 per cent. of the whole series of cases). Tables III and IV show that it is easier to secure anatomical reposition by operative means than by non-operative, but also demonstrate that good function follows in a larger proportion of cases where anatomical reposition is secured without operation than when operation is done (88 per cent. compared to 77 per cent. of cases). But it should, of course, be borne in mind that the group of cases treated without operation includes practically all fractures without primary displacement of the fragments, and that operation has usually been adopted only where marked displacement of the fragments existed. However, it is most noteworthy that *even by operative means anatomical reposition was secured in less than three-fourths of cases* (72 per cent.). These tables also show that if anatomical reposition is not secured, but only approximate reduction is obtained (moderate anatomical results), very much better function follows non-operative than operative treatment (55 per cent. of good function compared to 21 per cent.). Even bad anatomical results under non-operative treatment give good functional results in very nearly as large a proportion of cases (20 per cent.) as is secured when only moderate anatomical results follow operative treatment (21 per cent.). It is evident that unless anatomical reposition of the fragments is obtained by operation, *the slight improvement in the position of the fragments that is obtained short of perfection does not compensate for the additional injury to the soft parts entailed by the operation.*

Comments on Tables V, VI, and VII. Table V. In patients under fifteen years of age good functional results depend less upon good anatomical results than in older patients, and the bad functional results are almost negligible (3 per cent.). The older the patients the greater is the proportion of bad results, and the more certainly do such bad results follow failure to secure anatomical reposition of the fragments. The proportion of good functional results secured from moderate and bad anatomical results grows progressively less the older the patient.

Table VI and VII. When operative treatment[1] is compared with non-operative treatment, the facts observed in the analysis of Tables III and IV become still more apparent. While it is easier in almost all age periods to secure anatomical reposition by operation than without, yet the proportion of good functional results following such reposition is higher when it is obtained without operation, and if only moderate reduction is obtained the proportion of good functional results is very much higher when no operation is done. This brings one to the conclusion that unless the surgeon is reasonably certain of securing accurate anatomical reduction by operative means, he will do better to leave the fracture unreduced. Certainly under fifteen years of age, where only moderate reduction secures good function in as high as 85 per cent. of cases, there is very little excuse for operation as an habitual practice.

These tables confirm the point emphasized by the Fractures Committee of the British Medical Association,[2] that the older

[1] The operative cases in these tables belong to Class A and Class B of the classification of the Fractures Committee of the British Medical Association. None of Class C are included. It has not been practicable to separate Classes A and B.

Class A are operations undertaken immediately without any attempts at non-operative treatment.

Class B are operations undertaken only after non-operative treatment has been tried and failed. (This Committee of the American Surgical Association has followed the example of the Committee of the British Medical Association in accepting without question the decision of the attendant as to whether or not the attempts at non-operative treatment were efficient.)

Class C are operations undertaken for malunion, non-union, etc.

[2] Brit. Med. Jour., 1912, ii, 1505.

the patient the more important it is to secure anatomical reposition. But *they do not indicate* that more patients will secure good function if treated by operation than if no operation is done. The only exception to this rule appears to be in the case of patients more than sixty years old; but the number of such patients treated by operation (11 only) is far too small in this series to be considered authoritative. If patients from fifteen to forty-five years of age are considered, it is evident that by operation a good anatomical result will be secured in a larger proportion of cases than by non-operative treatment (74 per cent. compared to 46 per cent.), but the total number of patients in this group who secure a good functional result is higher when no operation is done than when operation is employed (62 per cent. compared to 58 per cent.); and in the next age group (forty-five to sixty years) although a higher proportion of good anatomical results follows non-operative than operative treatment (42 per cent. compared to 37 per cent.), the same excess of total good functional results is to be credited to non-operative treatment as was seen in the previous age period (47 per cent. from non-operative treatment compared to 33 per cent. from operative treatment).

It is worth while here, we think, to pause and study these operative cases in greater detail. Why did one out of every 10 cases treated by operation secure only a bad anatomical result, and why also was the functional result bad in as many as 10 per cent. of cases? Why was a good anatomical result obtained only in 72 per cent. of cases, and a good functional result only in 61 per cent. of cases? It has been pointed out already, in commenting on Tables II, III, and IV, that in most of the operative cases the fragments were much displaced, and that this was the indication for operation; whereas in a large proportion of the cases treated without operation the fragments never were displaced, and really no reduction was required. In a certain proportion of cases where operation was employed, however, and where there was already marked displacement of the fragments, the surgeon was enabled by operation to secure a good anatomi-

cal result; those cases in which he was not able to secure anatomical reduction by means of operation presumably were very difficult cases. But extenuate these results as we may, there is one fact from which we cannot get away: it is the question of *infection*. Out of 210 operations for closed fractures (all of them clean wounds, none of them primarily infected), no less than twelve wounds, or over 5 per cent. of the whole series, became infected during the operation. Out of 8 operations on the shaft of the humerus, 2, or 25 per cent. were infected; out of 100 operations on the shaft of the femur, 7, or 7 per cent., were infected; and out of 19 operations on the shaft of the tibia 2, or about 10 per cent., were infected. Such a record of infection in a series of operations for hernia should be considered scandalous; and it is scandalous in a series of operations for simple fractures. And it may be remarked that while all the good operative results were obtained by good surgeons, the infected cases are not the sole property of bad surgeons.

The number of deaths following operations for simple fractures has not been recorded. Some deaths there were; but as many series of case records contained only the reports of end-results in patients who recovered, and did not report any fatal cases at all (either operative or non-operative), it would be unfair to calculate the mortality of fractures in general from the records at hand. In 2 cases where infection was caused by the operation it proved so severe that amputation had to be done, one for fracture of the femur and one for fracture of the tibia. There were 2 deaths, of 1.3 per cent., among 147 operations for fractures reported by the Fractures Committee of the British Medical Association, all of these operations belonging to Class A (*i. e.*, where immediate operation was undertaken without attempt at non-operative treatment). Neither of these deaths, however, was chargeable directly to the operation. Lambotte, according to Appendix C, of the same report, had 9 deaths (1.5 per cent.) among 567 fracture operations of all classes.

The results differ according as the fracture occurs *in the shaft* of the long bones, or *near the joints*. ("Quo propior fractura capiti vel superiori vel inferiori est, eo pejor est." Cels. viii, 10.)

TABLE VIII.—575 FRACTURES OF THE SHAFTS OF LONG BONES

I. NON-OPERATIVE

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
Good . . .	207 (49%)	183 (88%)	23 (11%)	1 (0.5)
Moderate . .	147 (35%)	93 (63%)	44 (30%)	10 (7%)
Bad	63 (15%)	17 (26%)	15 (24%)	31 (50%)
Total . .	417	293 (70%)	82 (20%)	42 (10%

II. OPERATIVE

Good . . .	112 (72%)	89 (79%)	20 (18%)	3 (3%)
Moderate . .	27 (17%)	8 (29%)	15 (55%)	4 (15%)
Bad	19 (12%)	4 (21%)	5 (26%)	10 (53%)
Total . .	158	101 (64%)	40 (25%)	17 (11%)

III. ALL CASES

Good . . .	319 (55%)	272 (86%)	43 (13%)	4 (1%)
Moderate . .	174 (30%)	101 (59%)	59 (33%)	14 (8%)
Bad	82 (14%)	21 (26%)	20 (24%)	41 (50%)
Total . .	575	394 (68%)	122 (21%)	59 (10%)

TABLE IX. 254 FRACTURES NEAR JOINTS

I. NON-OPERATIVE

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
Good . . .	112 (55%)	97 (86%)	10 (9%)	5 (4%)
Moderate . .	66 (33%)	24 (42%)	30 (38%)	12 (20%)
Bad	24 (11%)	1 (4%)	4 (16%)	19 (79%)
Total . .	202	122 (60%)	44 (22%)	36 (18%)

II. OPERATIVE

Good . . .	38 (73%)	26 (68%)	10 (26%)	2 (5%)
Moderate . .	12 (23%)	1 (8%)	10 (83%)	1 (8%)
Bad	2 (4%)	0 (—)	1 (50%)	1 (50%)
Total . .	52	27 (52%)	21 (40%)	4 (8%)

III. ALL CASES

Good . . .	150 (59%)	123 (82%)	20 (13%)	7 (4%)
Moderate . .	78 (30%)	25 (32%)	40 (51%)	13 (16%)
Bad	26 (10%)	1 (4%)	5 (19%)	20 (77%)
Total . .	254	149 (58%)	65 (25%)	40 (16%)

TABLE X.—HUMERUS

Anatomical		Functional							
		Total		Good		Moderate		Bad	
		Non-operative.	Operative.	Non-operative.	Operative.	Non-operative.	Operative.	Non-operative.	Operative.
SHOULDER	Good	10	9	9	6	..	2	1	1
	Moderate	4	5	3	1	1	4	..	..
	Bad	1	1	..	..	1	..	..	1
	Total	15	15	12	7	2	6	1	2
	Per cent.	100	100	80	47	13	40	7	13
SHAFT	Good	9	6	9	1	..	4	..	1
	Moderate	9	1	6	..	2	1	1	
	Bad	1	1	1	..	..	..	..	1
	Total	19	8	16	1	2	5	1	2
	Per cent.	100	100	84	13	10	62	6	25
ELBOW	Good	43	10	43	7	..	2	..	1
	Moderate	11	3	8	..	3	2	..	1
	Bad	2	...	1	..	1			
	Total	56	13	52	7	4	4	..	2
	Per cent.	100	100	93	54	7	31	..	15
ENTIRE HUMERUS	Grand total	90	36	80	15	8	15	2	6
	Per cent.	100	100	90	42	8	42	2	16

Operations in black face figures.

TABLE XI.—RADIUS AND ULNA

Anatomical		Functional							
		Total		Good		Moderate		Bad	
		Non-operative.	Operative.	Non-operative.	Operative.	Non-operative.	Operative.	Non-operative.	Operative.
SHAFT	Good	32	18	32	17	..	1		
	Moderate	15	5	12	..	2	4	1	1
	Bad	6	1	4	..	..	1	2	
	Total	53	24	48	17	2	6	3	1
	Per cent.	100	100	90	71	4	25	6	4
WRIST	Good	7	3	6	2	..	1	1	
	Moderate	3	0	3					
	Bad	2	0	..	..	..	..	2	
	Total	12	3	9	2	..	1	3	
	Per cent.	100	100	75	66	..	33	25	
ENTIRE FOREARM	Grand total	65	27	57	19	2	7	6	1
	Per cent.	100	100	88	70	3	26	9	4

Operations in black face figures.

Though it is evident from these tables (VIII and IX) that good functional results are most certain to follow good anatomical results, the most noteworthy fact demonstrated is that *it is very much more important to secure anatomical reposition of the fragments in the case of joint fractures than in fractures in the shafts of the long bones.* In the latter case (shaft fractures) bad function follows a bad anatomical result in only half the cases; whereas in the case of joint fractures a bad anatomical result insures a bad functional result in over three-fourths of cases (77 per cent.). In the shafts of the long bones, a moderate anatomical result secures good function in 59 per cent. of cases; but if the fracture is near a joint, good function follows a moderate anatomical result only in 32 per cent. of cases.

TABLE XII.—FEMUR

Anatomical		Functional							
		Total		Good		Moderate		Bad	
		Non-operative.	Operative.	Non-operative.	Operative.	Non-operative.	Operative.	Non-operative.	Operative.
Neck	Good	16	5	10	2	4	3	2	0
	Moderate	36	1	5	0	21	1	10	0
	Bad	11	0	0	0	2	0	9	0
	Total	63	6	15	2	27	4	21	0
	Per cent.	100	100	24	33	43	66	33	
Trochanters	Good	4	1	3	1	0	0	1	0
	Moderate	4	2	1	0	2	2	1	0
	Bad	0	1	0	0	0	1	0	0
	Total	8	4	4	1	2	3	2	0
	Per cent.	100	100	50	25	25	75	25	
Shaft	Good	115	70	103	56	11	14	1	0
	Moderate	101	15	62	7	35	6	4	2
	Bad	48	15	12	3	13	3	23	9
	Total	264	100	177	66	59	23	28	11
	Per cent.	100	100	67	66	17	23	12	11
Condyles	Good	1	4	1	1	0	3	0	0
	Moderate	3	0	2	0	0	0	1	0
	Bad	0	0	0	0	0	0	0	0
	Total	4	4	3	1	0	3	1	0
	Per cent.	100	100	75	25	..	75	25	
Entire Femur	Grand total	339	114	199	70	88	33	52	11
	Per cent.	100	100	58	61	26	29	15	9

Operations in black face figures.

TABLE XIII.—TIBIA AND FIBULA

Anatomical		Functional							
		Total		Good		Moderate		Bad	
		Non-operative.	Operative.	Non-operative.	Operative.	Non-operative.	Operative.	Non-operative.	Operative.
Shafts (also shaft of tibia alone 24 cases)	Good	45	15	34	13	11	1	0	1
	Moderate	21	3	12	0	5	2	4	1
	Bad	7	1	0	0	1	1	6	0
	Total	73	19	46	13	17	4	10	2
	Per cent.	100	100	66	65	25	23	9	12
Ankle (all forms)	Good	32		25		6		1	
	Moderate	5		2		3		0	
	Bad	7		0		0		7	
	Total	44		27		9		8	
	Per cent.	100		62		20		18	
Entire Leg	Grand total	117		73		26		18	
	Per cent.	100		62		22		15	

Operations in black face figures.

Comments on Tables X, XI, XII, and XIII. These tables show the anatomical and functional results in the more important groups of fractures. Table X includes, under the general heading "shoulder," fractures of the surgical neck, anatomical neck and tuberosities of the humerus as well as separations of the upper epiphysis of this bone; there are so few cases in all (15) that a separate classification is not practicable. Likewise under the heading "elbow" are included all fractures of the lower end of the humerus. In Table XI under "wrist" are included Colles's fractures, epiphyseal separations, etc. In Table XII there are included under "neck" both intracapsular and extracapsular fractures, impacted or unimpacted; as the exact site of the fracture was not indicated in a great many cases it was not possible to give a more accurate classification. Fractures through the trochanters, however, have been classified separ-

ately. All fractures of the shaft are grouped together; while those of the "condyles" include supracondylar fractures (only such as are within 10 cm. of the base of the condyles should be so named), epiphyseal separations, and fractures of one or other condyle into the knee-joint. In Table XIII fractures of the shaft of the tibia alone have been grouped together with fractures of the shafts of both tibia and fibula; and all forms of fractures at the ankle have been grouped together.

Comments on Tables XIV and XV. In Tables XIV and XV the foregoing tables (X, XI, XII, XIII) are summarized and compared with the functional results in similar groups of cases reported by the British Fractures Committee. The non-operative cases are tabulated first, giving the total number of cases observed, and the total number of cases in which a good functional result was secured, regardless of the anatomical result.

In the British report were tabulated a total of 1040 operations and these were classified as Class A, Class B, and Class C. (See footnote, p. 35.) It has not, however, been possible to classify the present series of operative cases on this plan, mainly owing to lack of details. The 210 operative cases which it has been possible to analyze represent exclusively Classes A and B, though the exact proportions are not known; it is certain, however, that comparatively few of the operations belong in Class A. This point should be constantly borne in mind in making comparisons in the following tables, since the British figures refer exclusively to operations in Class A. Where no figures are given in Table XV, either no operations are recorded or at most only one operation in the special region of the bone investigated.

TABLE XIV.—GOOD FUNCTIONAL RESULTS FOLLOWING NON-OPERATIVE TREATMENT

Site.	American Surgical Association.		British Medical Association.	
	Total.	Good function.	Total.	Good function.
Humerus, shoulder	15	12 (80%)	53	35 (66%)
Humerus, shaft	19	16 (84%)	73	60 (82%)
Humerus, elbow	56	52 (93%)	101	61 (60%)
Total	90	80 (90%)	227	156 (68%)
Radius and ulna, shafts	53	48 (90%)	76	42 (55%)
Radius and ulna, wrist	12	9 (75%)	62	39 (63%)
Total	65	57 (88%)	138	81 (58%)
Upper extremity	155	137 (88%)	365	237 (65%)
Femur, neck	63	15 (24%)	91	24 (26%)
Femur, shaft	264	177 (67%)	638	509 (79.8%)
Femur, condyles	4	3 (75%)	21	12 (57%)
Total	331	195 (59%)	750	545 (72%)
Tibia and Fibula, shafts	73	46 (66%)	975	748 (76%)
Ankle fractures	44	27 (62%)	255	125 (49%)
Leg bones, total	117	73 (62%)	1230	873 (71%)
Lower extremity	448	268 (60%)	1980	1418 (71%)

TABLE XV.—GOOD FUNCTIONAL RESULTS FOLLOWING OPERATIVE TREATMENT

Site.	American Surgical Association.		British Medical Association.	
	Total.	Good function.	Total.	Good function.
Humerus, shoulder	15	7 (47%)	10	8 (80%)
Humerus, shaft	8	1 (13%)	6	5 (83%)
Humerus, elbow	13	7 (54%)	16	11 (68.7%)
Total	36	15 (42%)	32	24 (75%)
Radius and ulna, shafts	24	17 (71%)	15	11 (73%)
Radius and ulna, wrist	3	2 (66%)	2	2 (100%)
Forearm, total	27	19 (70%)	17	13 (76%)
Upper extremity	63	34 (54%)	49	37 (75%)
Femur, neck	6	2 (33%)		
Femur, shaft	100	66 (66%)	32	29 (90%)
Femur, condyles	4	1 (25%)		
Total	110	69 (62%)	32	29 (90%)
Tibia and fibula, shafts	19	13 (65%)	39	31 (79%)
Ankle fractures	..	.. ..	4	2 (50%)
Leg bones, total	19	13 (65%)	43	33 (76%)
Lower extremity	129	82 (63%)	75	62 (82%)

QUESTION I (*b*). DOES A GOOD ANATOMICAL RESULT LESSEN THE PERIOD OF DISABILITY?

An attempt has been made to answer this question in Tables XVI, XVII, XVIII, XIX, XX, XXI, and XXII. It is much to be regretted that the *period of disability* is known in so few cases (532), and that these are so scattered among the various sites of fracture that to obtain any satisfactory figures it has been necessary to group the cases in rather an artificial manner. It has seemed, on the whole, more accurate to rely on the figures which give the proportion of patients who recover their function (whether good, moderate, or bad) within a given period (Tables XVII, XVIII, XIX, XX), rather than on the average period of disability for all cases in a given region. The latter calculation is necessarily inaccurate in most instances, as the period of disability often is recorded merely as "over one year," "over two years," etc. As a working rule, however, it may be considered that patients with fractures of the upper extremity who are still incapacitated after more than twenty-four weeks (approximately six months) will be more or less permanently incapacitated, and that a period of twelve months may be applied similarly to fractures of the lower extremity. According to this reckoning the following table has been constructed:

TABLE XVI.—AVERAGE PERIOD OF DISABILITY

Site of fracture.	All cases.	Average period of disability, weeks.	Cases terminated under 24 weeks.	Average period of disability, weeks.
Humerus, shoulder	18	11.5	17	10.9
Humerus, shaft	19	14.0	16	12.0
Humerus, elbow	23	9.0	22	8.2
Radius and ulna, shafts	26	10.8	25	10.3
Site of fracture.	**All cases.**	**Average period of disability, months.**	**Cases terminated under 12 months.**	**Average period of disability, months.**
Femur, neck	51	8.1	32	6.5
Femur, shaft	196	7.1	168	6.3
Tibia or tibia and fibula, shafts	66	4.9	61	4.25
Ankle	29	4.9	28	4.28

TABLE XVII.—PERIOD OF DISABILITY IN FRACTURES OF THE UPPER EXTREMITY

Anatomical result.	Total.	Period of disability. Under 6 weeks.	Under 12 weeks.	Under 24 weeks.	Over 24 weeks.
Good	58	35 (60.0%)	15 (26.0%)	6 (10%)	2 (3%)
Moderate	20	8 (40.0%)	6 (30.0%)	2 (10%)	4 (20%)
Bad	8	1 (12.5%)	5 (62.5%)	2 (25%)	0 (0)

TABLE XVIII.—DOES GOOD ANATOMICAL RESULT LESSEN PERIOD OF DISABILITY?

	Anatomical results		Period of Disability.											
		Total	Under 6 weeks.			Under 12 weeks.			Under 24 weeks.			Over 24 weeks.		
			Shoulder	Shaft	Elbow	Shoulder	Shaft	Elbow	Shoulder	Shaft	Elbow	Shoulder	Shaft	Elbow
HUMERUS 60 cases	Good	41	6	4	12	4	3	5	3	2	0	1	1	0
	Per cent.	..	43	40	70	29	30	30	21	20	..	7	10	
	Moderate	16	3	2	2	0	3	2	0	1	0	0	2	1
	Per cent.	..	100	25	40	..	38	40	..	12	..	..	25	20
	Bad	3	0	0	0	1	1	1	0	0	0	0	0	0
	Per cent.	..	..	..	..	100	100	100						
	Total	60	29			20			6			5		
	Per cent.	..	48			33			10			9		
FOREARM (shafts of either or of both bones) 26 cases	Good	17	13			3			1					
	Per cent.	..	76			18			6					
	Moderate	4	1			1			1			1		
	Per cent.	..	25			25			25			25		
	Bad	5	1			2			2					
	Per cent.	..	20			40			40					
	Total	26	15			6			4			1		
	Per cent.	..	58			23			15			4		

Table XVII, which is elaborated in Table XVIII, seems to show that the period of disability depends very little upon the anatomical result, except for patients who recover function within six weeks. But the fallacy is evidently due to the small total number of cases observed.

TABLE XIX.—PERIOD OF DISABILITY IN FRACTURES OF THE FEMUR

Anatomical result.	Total.	Under 3 months.	Under 6 months.	Under 9 months.	Under 12 months.	Over 12 months.
NECK:						
Good .	16	6 (35%)	4 (25%)	0 (—)	3 (20%)	3 (20%)
Moderate	27	6 (22%)	7 (26%)	1 (4%)	4 (15%)	9 (33%)
Bad . .	8	0 (—)	2 (25%)	1 (12.5%)	0 (—)	5 (62.5%)
SHAFT:						
Good .	104	46 (44%)	27 (26%)	5 (5%)	23 (22%)	3 (3%)
Moderate	52	14 (27%)	15 (29%)	6 (11%)	10 (19%)	7 (13%)
Bad . .	40	7 (17%)	9 (22%)	3 (7.5%)	3 (7.5%)	18 (45%)

Table XIX, which gives the period of disability in fractures of the neck and shaft of the femur, is condensed in Table XX, which also includes a summary of fractures of the leg. The larger the number of cases examined the more trustworthy are the inferences drawn from the analysis. Thus Table XX indicates that if good anatomical results are obtained, 69 per cent. of fractures of the femur in general will recover function within six months, as compared with 53 per cent. if the anatomical result is only moderate, and only 38 per cent. if the anatomical result is bad. In the case of the leg bones the importance of a good anatomical result is even more striking; when a good anatomical result is obtained, no less than 92 per cent. of patients recover their function within six months; if only moderate anatomical results are secured, 80 per cent. will recover their function within this time; and if a bad anatomical result is present, only 25 per cent. of patients secure a return of function within six months.

TABLE XX.—DOES GOOD ANATOMICAL RESULT LESSEN PERIOD OF DISABILITY?

	Anatomical results.		Period of disability.				
		Total.	Under 3 mos.	Under 6 mos.	Under 9 mos.	Under 12 mos.	Over 12 mos.
Femur (all forms)	Good	120 (48%)	52 (44%)	31 (25%)	5 (4%)	26 (22%)	6 (5%)
	Moderate	79 (32%)	20 (25%)	22 (28%)	7 (9%)	14 (18%)	16 (20%)
	Bad	48 (20%)	7 (15%)	11 (23%)	4 (8%)	3 (6%)	23 (48%)
	Total	247 (100%)	79 (32%)	64 (26%)	16 (6%)	43 (17%)	45 (19%)
Leg (all forms)	Good	75 (75%)	52 (69%)	17 (23%)	4 (5%)	0 ..	2 (3%)
	Moderate	20 (20%)	8 (40%)	8 (40%)	1 (5%)	1 (5%)	2 (10%)
	Bad	4 (5%)	0 ..	1 (25%)	2 (50%)	0 ..	1 (25%)
	Total	99 (100%)	60 (60%)	26 (26%)	7 (7%)	1 (1%)	5 (5%)

TABLE XXI.—FEMUR, NECK. 51 CASES.

	Anatomical results.	Total.	Period of disability and functional results.														
			Under 3 mos.			Under 6 mos.			Under 9 mos.			Under 12 mos.			Over 12 mos.		
			Good.	Mod.	Bad.	Good.	Mod.	Bad.	Good.	Mod.	Bad.	Good.	Mod.	Bad.	Good.	Mod.	Bad.
Under 15 years	Good	4	4	0	0												
	Moderate	1	0	0	1												
	Bad	0	0	0	0												
15 to 45 years	Good	3	1	..	..	1	..	..	..	..	..	..	1				
	Moderate	6	..	4	..	..	..	..	..	..	..	..	..	1	..	..	1
	Bad	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1
45 to 60 years	Good	4	..	..	..	1	..	..	..	..	..	..	2	..	..	1	
	Moderate	8	1	..	..	..	1	..	..	..	..	1	..	..	..	3	2
	Bad	4	..	..	..	..	..	..	..	..	1	..	..	..	..	..	3
Over 60 years	Good	5	..	1	..	2	..	..	..	..	..	..	..	..	..	1	1
	Moderate	12	..	..	..	..	5	1	..	1	..	..	2	..	..	1	2
	Bad	3	..	..	..	..	1	1	..	..	..	..	..	..	..	..	1
All ages	Good	16	5	1	0	4	0	0	0	0	0	0	3	0	0	2	1
	Moderate	27	1	4	1	0	6	1	0	1	0	1	2	1	0	4	5
	Bad	8	0	0	0	0	1	1	0	0	1	0	0	0	0	0	5

TABLE XXII.—FEMUR, SHAFT. 196 CASES.

	Anatomical results.	Total.	Period of disability and functional results.														
			Under 3 mos.			Under 6 mos.			Under 9 mos.			Under 12 mos.			Over 12 mos.		
			Good.	Mod.	Bad.	Good.	Mod.	Bad.	Good.	Mod.	Bad.	Good.	Mod.	Bad.	Good.	Mod.	Bad.
Under 15 years	Good	54	32	2	..	5	2	..	1	..	..	12					
	Moderate	15	9	2	..	2	..	..	..	..	..	2					
	Bad	8	2	..	4	..	..	1	..	..	..	..	..	..	1		
15 to 45 years	Good	34	7	..	..	12	3	..	2	1	..	8	..	..	..	1	
	Moderate	23	3	..	..	7	2	..	5	1	..	1	4				
	Bad	14	..	..	..	5	..	..	3	..	..	..	2	..	1	1	2
45 to 60 years	Good	12	5	..	..	3	..	..	1	..	..	1	1	..	..	1	
	Moderate	9	..	..	..	2	1	..	..	..	..	2	..	..	..	2	2
	Bad	10	1	..	..	1	2	..	..	..	..	..	..	..	..	..	6
Over 60 years	Good	4	..	..	..	2	..	..	..	..	..	1	..	..	..	1	
	Moderate	5	..	..	..	1	..	..	..	..	..	1	..	..	..	2	1
	Bad	8	..	..	..	..	..	..	..	..	..	..	1	..	..	1	6
All ages	Good	104	44	2	0	22	5	0	4	1	0	22	1	0	0	3	0
	Moderate	52	12	2	0	12	3	0	5	1	0	6	4	0	0	4	3
	Bad	40	3	0	4	6	2	1	3	0	0	0	3	0	2	2	14

TABLE XXIII.—FEMUR, SHAFT. OPERATIVE COMPARED WITH NON-OPERATIVE TREATMENT

Age.	Number of cases.		Period of disability.				
			Under 3 mos.	Under 6 mos.	Under 9 mos.	Under 12 mos.	Over 12 mos.
Under 15 years	77	Non-operative . . . 61 (79%)	40 (66%)	7 (12%)	.. ..	13 (22%)	1 (0.5%)
		Operative 16 (21%)	11 (69%)	3 (19%)	1 (6%)	1 (6%)	
15 to 45 years	71	Non-operative . . . 44 (62%)	4 (9%)	14 (32%)	8 (18%)	15 (34%)	3 (7%)
		Operative 27 (38%)	6 (22%)	14 (52%)	4 (15%)	1 (4%)	2 (7%)
45 to 60 years	31	Non-operative . . . 24 (78%)	5 (21%)	8 (33%)	1 (4%)	3 (12%)	7 (30%)
		Operative 7 (22%)	1 (14%)	1 (14%)	.. ..	1 (14%)	4 (57%)
Over 60 years	17	Non-operative . . . 15 (88%)	.. ..	1 (7%)	.. ..	3 (20%)	11 (73%)
		Operative 2 (12%)	.. ..	2 (100%)			
All ages	196	Non-operative . . . 144 (73%)	49 (34%)	30 (20%)	9 (6%)	34 (24%)	22 (15%)
		Operative 52 (27%)	18 (35%)	20 (38%)	5 (9%)	3 (6%)	6 (12%)

TABLE XXIV.—FEMUR, SHAFT. OPERATIVE COMPARED WITH NON-OPERATIVE TREATMENT

Age.	Number of cases.		Period of disability.		
			Under 6 mos.	Under 12 mos.	Over 12 mos.
Under 15 years	77	Non-operative 61 (79%)	47 (78%)	13 (22%)	1 (0.5%)
		Operative 16 (21%)	14 (88%)	2 (12%)	
15 to 45 years	71	Non-operative 44 (62%)	18 (41%)	23 (52%)	3 (7%)
		Operative 27 (38%)	20 (74%)	5 (19%)	2 (7%)
45 to 60 years	31	Non-operative 24 (78%)	13 (54%)	4 (16%)	7 (30%)
		Operative 7 (22%)	2 (28%)	1 (14%)	4 (57%)
Over 60 years	17	Non-operative 15 (88%)	1 (7%)	3 (20%)	11 (73%)
		Operative 2 (12%)	2 (100%)		
All ages	196	Non-operative 144 (73%)	79 (54%)	43 (30%)	22 (15%)
		Operative 52 (27%)	38 (73%)	8 (15%)	6 (12%)

Table XXI and XXII contain analyses of fractures of the shaft and neck of the femur according to age, functional results, and period of disability.

Question II. Does Operative Treatment Lessen the Period of Disability?

It has been impossible, with the data at hand, to give a satisfactory answer to this question. The only region for which anywhere near a sufficient number of operative cases is available is the shaft of the femur, and even here the total in which the period of disability is known is lamentably small, only 52 cases. These 52 cases, however, have been compared with the available number (144) of non-operative cases in Tables XXIII and XXIV. Table XXIV presents the figures in a slightly more condensed form. From this it appears that for patients under forty-five years of age or over sixty years of age operative treatment materially shortens the period of disability; but as already remarked the figures involved are entirely too small for any satisfactory solution to this question.

TABLE XXV.—TABLES TO SHOW THE RESULTS OF FRACTURES OF THE RADIUS AND ULNA

Radius and ulna.	Anatomical results.				Functional results.										
		Total.			Good.			Moderate.			Bad.				
		Non-operative.	Operative.		Non-operative.	Operative.		Non-operative.	Operative.		Non-operative.	Operative.			
			Immediate.	Deferred.		Immediate.	Deferred.		Immediate.	Deferred.		Immediate.	Deferred.		
Shaft .	Good . .	15	..	24	29	..	22								
	Moderate .	12	..	9	..	..	..	2	..	11					
	Bad . .	4	..	2	..	..	..	..	..	..	..	2			
	Total . .	31	..	35	29	..	22	2	..	11	..	2			
	Per cent. .	47	..	53	57	..	43	16	..	85	..	100			

TABLE XXVI.—TABLES TO SHOW THE RESULTS OF FRACTURES OF FEMUR IN THE VARIOUS AGE GROUPS

Femur. Group A. 1 to 15 years.	Anatomical results.				Functional results.								
		Total.			Good.			Moderate.			Bad.		
		Non-operative.	Operative. Immediate.	Operative. Deferred.	Non-operative.	Operative. Immediate.	Operative. Deferred.	Non-operative.	Operative. Immediate.	Operative. Deferred.	Non-operative.	Operative. Immediate.	Operative. Deferred.
Neck .	Good . .	3	3	..	3	3							
	Moderate .												
	Bad . .												
	Total . .	3	3	..	3	3							
	Per cent. .	100	100	..	100	100							
Shaft .	Good . .	67	..	24	86	..	29						
	Moderate .	28	..	4	..	..	..	11	..	6			
	Bad . .	4	..	8	..	..	..	..	..	..	2	..	1
	Total . .	99	..	36	86	..	29	11	..	6	2	..	1
	Per cent. .	73	..	26	75	..	25	65	..	35	66	..	33
Condyle	Good . .	1	..	..	1								
	Moderate .												
	Bad . .												
	Total . .	1	..	..	1								
	Per cent. .	100	..	..	100								
	Grand total	103	3	36	90	3	29	11	..	6	2	..	1
	Per cent. .	72	2	25	73	3	24	65	..	35	66	..	33

TABLE XXVII—TABLES TO SHOW THE RESULTS OF FRACTURES OF FEMUR IN THE VARIOUS AGE GROUPS

Femur. Group B. 15 to 45 years.	Anatomical results.				Functional results.								
		Total.			Good.			Moderate.			Bad.		
		Non-operative.	Operative. Immediate.	Operative. Deferred.	Non-operative.	Operative. Immediate.	Operative. Deferred.	Non-operative.	Operative. Immediate.	Operative. Deferred.	Non-operative.	Operative. Immediate.	Operative. Deferred.
Neck .	Good . .	6	1	1	5	1							
	Moderate .	3	..	..	..	..	..	5	..	4			
	Bad . .	2	..	4	..	..	..	..	..	..	1	..	1
	Total . .	11	1	5	5	1	..	5	..	4	1	..	1
	Per cent. .	65	6	29	83	17	..	55	..	44	50	..	50
Shaft .	Good . .	28	5	16	43	4	14						
	Moderate .	23	1	5	..	..	..	20	2	11			
	Bad . .	12	1	5	..	..	..	..	..	..	..	1	1
	Total . .	63	7	26	43	4	14	20	2	11	..	1	1
	Per cent. .	65	7	27	70	6	23	60	6	33	..	50	50
Condyle	Good . .	2	..	..	2								
	Moderate .	1	1	..	..	..	..	..	1				
	Bad . .	..	..	..	..	..	..	..	..	..	1		
	Total . .	3	1	..	2	..	..	..	1	..	1		
	Per cent. .	75	25	..	100	..	..	..	100	..	100		
	Grand total	77	9	31	50	5	14	25	3	15	2	1	2
	Per cent. .	66	7	26	72	7	20	58	7	35	40	20	40

TABLE XXVIII.—TABLES TO SHOW THE RESULTS OF FRACTURES OF FEMUR IN THE VARIOUS AGE GROUPS

Femur. Group D. 60 and over.		Anatomical results.			Functional results.								
		Total.			Good.			Moderate.			Bad.		
		Non-operative.	Operative.		Non-operative.	Operative.		Non-operative.	Operative.		Non-operative.	Operative.	
			Immediate.	Deferred.		Immediate.	Deferred.		Immediate.	Deferred.		Immediate.	Deferred.
Neck .	Good . .	6	..	..	5								
	Moderate .	4	1	..	..	..	..	4	1				
	Bad . .	4	..	..	..	..	..	..	..	..	5		
	Total . .	14	1	..	5	..	..	4	1	..	5		
	Per cent. .	93	5	..	100	..	..	80	20	..	100		
Shaft .	Good . .	3	..	..	2								
	Moderate .	5	..	..	..	..	..	8					
	Bad . .	8	..	..	..	..	..	..	..	..	7		
	Total . .	16	..	..	2	..	..	8	..	..	7		
	Per cent. .	100	..	..	100	..	..	100	..	..	100		
Condyle (no cases)	Good . .												
	Moderate .												
	Bad . .												
	Total . .												
	Per cent. .												
	Grand total	30	1	..	7	..	..	12	1	..	12		
	Per cent. .	97	3	..	100	..	..	92	7	..	100		

TABLE XXIX.—TABLES TO SHOW THE RESULTS OF FRACTURES OF FEMUR IN THE VARIOUS AGE GROUPS

Femur. All groups combined.		Anatomical results.			Functional results.								
		Total.			Good.			Moderate.			Bad.		
		Non-operative.	Operative.		Non-operative.	Operative.		Non-operative.	Operative.		Non-operative.	Operative.	
			Immediate.	Deferred.		Immediate.	Deferred.		Immediate.	Deferred.		Immediate.	Deferred.
Neck .	Good . .	19	4	2	13	4							
	Moderate .	12	1	2	3	..	..	17	1	7			
	Bad . .	9	..	5	..	..	..	..	..	..	7	..	2
	Total . .	40	5	9	16	4	..	17	1	7	7	..	2
	Per cent. .	74	9	16	80	20	..	68	4	28	77	..	22
Shaft .	Good . .	110	5	40	141	4	46						
	Moderate .	66	2	16	..	..	..	53	3	23			
	Bad . .	27	1	15	..	..	..	..	..	..	10	1	2
	Total . .	203	8	71	141	4	46	53	3	23	10	1	2
	Per cent. .	72	2	25	74	2	24	67	4	29	77	7	15
Condyle	Good . .	3	..	..	3								
	Moderate .	1	1	..	..	..	..	..	1				
	Bad . .	..	..	..	..	..	..	..	..	..	1		
	Total . .	4	1	..	3	..	..	..	1	..	1		
	Per cent. .	80	20	..	100	..	..	..	100	..	100		
	Grand total	247	14	80	160	8	46	70	5	30	18	1	4
	Per cent. .	72	4	23	75	3	21	66	4	27	78	4	17

Compound Fractures

The following statistics relate to compound fractures:

TABLE XXX.—COMPOUND FRACTURES; NON-OPERATIVE CASES

Fracture.	Age group, years.	No. of cases.	Upper extremity.					Died.
			Anatomical results.			Functional results.		
			Good.	Moderate.	Bad.	Good.	Moderate.	Bad.	
Humerus	1 to 15	2	2	....	....	2	....	....	....
Shaft	.....								
Humerus	15 to 45	1	1	....	....	1	....	....	....
Shaft	.....								
Humerus	45 to 60	1	1	....	....	1	....	....	....
Shaft	.....								
Humerus	60 to 90	No cases							
Ulna	1 to 15	No cases							
Ulna	15 to 45	2	2	....	....	2	....	....	....
Shaft	.....								
Ulna	45 to 60	No cases							
Ulna	60 to 90	No cases							
Radius	1 to 15	No cases							
Radius	15 to 45	1	1	....	....	1	....	....	....
Shaft	.....								
Radius	45 to 60	No cases							
Radius	60 to 90	No cases							
Radius and ulna	1 to 15	1	1	....	....	1	....	....	....
Shaft	.....								
Radius and ulna	15 to 45	2	2	....	....	1	1	....	....
Shaft	.....								
Radius and ulna	45 to 60	No cases							
Shaft	.....								
Radius and ulna	60 to 90	1	1	....	....	1	....	....	....
Shaft	.....								

TABLE XXX.—COMPOUND FRACTURES; NON-OPERATIVE CASES.—Continued

Fracture.	Age group, years.	No. of cases.	Lower extremity.						Died.
			Anatomical results.			Functional results.			
			Good.	Moderate.	Bad.	Good.	Moderate.	Bad.	
Femur	1 to 15								
Upper third	.....	2	2	....	....	2	....	....	
Middle third	.....	1	....	....	....	....	....	....	One of shock.
Lower third	.....	1	....	....	....	....	....	....	One of shock.
Femur	15 to 45								
Neck	.....	1	1	....	....	1	....	....	
Upper third	.....	2	2	....	....	2	....	....	
Middle third	.....	5	4	1	....	4	....	1	
Lower third	.....	3	3	....	....	2	1		
Femur	45 to 60								
Upper third	.....	2	2	....	....	2	....	....	
Middle third	.....	No cases							
Lower third	.....	1	....	....	1	....	....	1	
Femur	60 to 90								
Upper third	.....	No cases							
Middle third	.....	1	1	....	....	1	....	....	
Lower third	.....	1	....	....	....	....	....	....	One of shock.
Tibia	1 to 15								
Shaft	.....	1	....	1	....	....	1		
Tibia	15 to 45								
Shaft	.....	20	14	2	4	13	4	3	
Tibia	45 to 60								
Shaft	.....	11	6	3	2	8	1	2	

TABLE XXX.—COMPOUND FRACTURES; NON-OPERATIVE CASES.—Continued

Fracture.	Age group, years.	No. of cases.	Lower extremity.						Died.
			Anatomical results.			Functional results.			
			Good.	Moderate.	Bad.	Good.	Moderate.	Bad.	
Tibia	60 to 90								
Shaft	.....	2	1	1	....	1	1	....	
Fibula	1 to 15								
Shaft	.....	No cases							
Fibula	15 to 45								
Shaft	.....	3	2	1	....	....	2	1	
Fibula	45 to 60								
Shaft	.....	1	....	....	1	....	....	1	
Fibula	60 to 90								
Shaft	.....	2	1	1	....	1	1	....	
Tibia and fibula	1 to 15								
Shaft	.....	8	3	3	2	4	3	1	
Tibia and fibula	15 to 45								
Shaft	.....	51	37	12	1	39	10	1	One of shock.
Tibia and fibula	45 to 60								
Shaft	.....	16	13	....	....	12	1	....	One of shock; One of delirium tremens.
Tibia and fibula	60 to 90								
Shaft	.....	7	1	3	....	1	3	....	Two of shock; one from loss of blood.

Total upper extremity, 11 cases = 90 per cent. good functional results.
100 per cent. good anatomical results.
Total lower extremity, 132 cases = 66 per cent. good anatomical results.
76 per cent. good functional results.

TABLE XXXI.—COMPOUND FRACTURES; OPERATIVE CASES

Fracture.	Age group, years.	No. of cases.	Upper extremity.						Died.
			Anatomical results.			Functional results.			
			Good.	Moderate.	Bad.	Good.	Moderate.	Bad.	
Humerus	1 to 15	No cases							
Humerus Shaft	15 to 45	6	5	1	....	6	....	....	
Humerus	45 to 60								
Shaft	.....	No cases							
Humerus	60 to 90	No cases							
Radius	1 to 15	No cases							
Radius	15 to 45								
Shaft	.....	1	1	....	....	1	....	....	
Radius	45 to 60								
Shaft	.....	1	1	....	....	1	....	....	
Radius	60 to 90	No cases							
Ulna	1 to 15	No cases							
Ulna	15 to 45								
Shaft	.....	1	....	....	....	....	....	....	One loss blood.
Ulna	45 to 60	No cases							
Ulna	60 to 90	No cases							
Radius and ulna	1 to 15								
Shaft	.....	2	1	1	....	1	1	....	
Radius and ulna	15 to 45								
Shaft	.....	4	4	....	....	4	....	....	
Radius and ulna	45 to 60								
Shaft	.....	1	1	....	....	1	....	....	
Radius and ulna	60 to 90	No cases							

TABLE XXXI.—COMPOUND FRACTURES; OPERATIVE CASES.—Continued

Fracture.	Age group, years.	No. of cases.	Lower extremity.						Died.
			Anatomical results.			Functional results.			
			Good.	Moderate.	Bad.	Good.	Moderate.	Bad.	
Femur	1 to 15								
Upper third	.....	No cases							
Middle third	.....	2	1	....	1	1	1	....	
Lower third	.....	7	4	....	2	4	....	2	One of shock.
Femur	15 to 45								
Upper third	.....	3	3	....	....	3	....	....	
Middle third	.....	5	4	....	....	4	....	....	One from loss of blood.
Lower third	.....	17	12	2	3	14	....	3	
Femur	45 to 60								
Upper third	.....	No cases							
Middle third	.....	3	....	....	1	....	....	1	Two of shock.
Lower third	.....	1	....	....	1	....	....	1	
Femur	60 to 90								
Upper third	.....	No cases							
Middle third	.....	No cases							
Lower third	.....	No cases							
Tibia	1 to 15								
Shaft	.....	2	....	....	1	....	....	1	One of shock.
Tibia	15 to 45								
Shaft	.....	18	13	....	3	12	....	4	Two of shock.
Tibia	45 to 60								
Shaft	.....	2	....	....	2	1	....	1	

TABLE XXXI.—COMPOUND FRACTURES; OPERATIVE CASES.—Continued

Fracture.	Age group, years.	No. of cases.	Lower extremity.						Died.
			Anatomical results.			Functional results.			
			Good.	Moderate.	Bad.	Good.	Moderate.	Bad.	
Tibia	60 to 90	No cases							
Fibula	1 to 15								
Shaft	.....	1	1	....	....	....	....	1	
Fibula	15 to 45								
Shaft	.....	1	....	....	1	....	....	1	
Fibula	45 to 60								
Shaft	.....	1	1	....	....	1	....	....	
Fibula	60 to 90								
Shaft	.....	1	....	1	....	....	....	1	
Tibia and fibula	1 to 15								
Shaft	.....	6	3	2	1	3	2	1	
Tibia and fibula	15 to 45								
Shaft	.....	38	20	12	3	19	10	6	Three of shock.
Tibia and fibula	45 to 60								
Shaft	.....	6	4	....	2	5	....	1	
Tibia and fibula	60 to 90								

Total upper extremity, 16 cases = 80 per cent. good anatomical results.
93 per cent. good functional results.
Total lower extremity, 104 cases = 64 per cent. good anatomical results.
69 per cent. good functional results.
Ten deaths, almost 10 per cent. mortality, all due to shock or loss of blood.

The non-operative cases grouped in the age periods show:

(*a*) Compound Fracture of the Upper Extremity

1 to 15 years:

2	cases	of	compound fracture	of humerus.
0	"	"	"	radius.
0	"	"	"	ulna.
1	"	"	"	both bones of forearm.
Total 3	"			

15 to 45 years:

1	cases	of	compound fracture	of shaft of humerus.
1	"	"	"	" radius.
2	"	"	"	" ulna.
2	"	"	"	" both bones of forearm.
Total 6	"			

45 to 60 years:

1	cases	of	compound fracture	of shaft of humerus.
0	"	"	"	" radius.
0	"	"	"	" ulna.
0	"	"	"	" both bones of forearm.
Total 1	"			

60 to 90 years:

0	cases	of	compound fracture	of shaft of humerus.
0	"	"	"	" radius.
0	"	"	"	" ulna.
1	"	"	"	" both bones of forearm.
Total 1	"			

(*b*) Compound Fracture of the Lower Extremity

1 to 15 years:

4	cases	of	compound fracture	of shaft of femur.
1	"	"	"	" tibia.
0	"	"	"	" fibula.
8	"	"	"	" both bones of leg.
Total 13	"			

15 to 45 years:

11	cases	of	compound fracture	of shaft of femur.
20	"	"	"	" tibia.
3	"	"	"	" fibula.
51	"	"	"	" both bones of leg.
Total 85	"			

45 to 60 years:

3	cases	of	compound	fracture	of shaft of femur.
11	"	"	"	"	tibia.
1	"	"	"	"	fibula.
16	"	"	"	"	both bones of leg.
Total 31	"				

60 to 90 years:

2	cases	of	compound	fracture	of shaft of femur.
2	"	"	"	"	tibia.
2	"	"	"	"	fibula.
7	"	"	"	"	both bones of leg.
Total 13	"				

The operative cases grouped in the age periods show:

(*a*) Compound Fractures of the Upper Extremity

1 to 15 years:

0	cases	of	compound	fracture of humerus.
0	"	"	"	radius.
0	"	"	"	ulna.
1	"	"	"	both bones of forearm.
Total 1	"			

15 to 45 years:

6	cases	of	compound	fracture of shaft of humerus.
1	"	"	"	radius.
1	"	"	"	ulna.
4	"	"	"	both bones of forearm.
Total 12	"			

45 to 60 years:

0	cases	of	compound	fracture of shaft of humerus.
1	"	"	"	radius.
0	"	"	"	ulna.
1	"	"	"	both bones for forearm.
Total 2	"			

60 and over:

No cases.

(*b*) Compound Fractures of the Lower Extremity

1 to 15 years:

9	cases	of	compound	fracture of femur.
2	"	"	"	tibia.
1	"	"	"	fibula.
6	"	"	"	shaft of both bones of leg.
Total 18	"			

15 to 45 years:

25	cases	of	compound	fracture of shaft of	femur.
18	"	"	"	"	tibia.
1	"	"	"	"	fibula.
38	"	"	"	"	both bones of leg.
Total 82	"				

45 to 60 years:

4	cases	of	compound	fracture of shaft of	femur.
2	"	"	"	"	tibia.
1	"	"	"	"	fibula.
6	"	"	"	"	both bones of leg.
Total 13	"				

60 and over:

0	cases	of	compound	fracture of shaft of	femur.
0	"	"	"	"	tibia.
1	"	"	"	"	fibula.
0	"	"	"	"	both bones of leg.
Total 1	"				

NOTE: Very few cases of compound fractures of the bones of the upper extremity occur in the one to fifteen-year period and these are rarely operated on. The lower extremity shows a moderate number of compound fractures during this period and the majority of them are operated on. The middle period, namely, fifteen to forty-five years, shows by far the most cases and the majority are operative cases.

TABLE XXXII.—COMPARATIVE RESULTS OF OPERATIVE AND NON-OPERATIVE CASES OF COMPOUND FRACTURES.

	Operative cases.			Non-operative cases.		
	Cases.	Good anatomical results.	Good functional results.	Cases.	Good anatomical results.	Good functional results.
Humerus (shaft)	6	83%	100%	4	100%	100%
Radius (shaft)	2	100%	100%	1	100%	100%
Ulna (shaft)	1	100%	100%	2	100%	100%
Radius and ulna	6	83%	100%	4	100%	50%
Femur (shaft)	38	73%	76%	20	80%	70%
Tibia (shaft)	22	59%	68%	34	61%	64%
Fibula (shaft)	4	50%	100%	6	50%	16%
Tibia and fibula	50	60%	60%	82	65%	68%
Total	129			153		

TABLE XXXIII.—INFLUENCE ON RESULT OF TIME ELAPSING BETWEEN INJURY AND EFFICIENT TREATMENT

				Time after injury.							
				0 to 7 days.	8 to 14 days.	15 to 21 days.	22 to 28 days.	60 days.	90 days.	180 days.	
Humerus	..	71	Cases operated	24	14	4	8	5	4	3	
Humerus	46	..	Cases not operated	..	..	..	..	..	..	..	Time of treatment, unstated.
Radius	..	22	Cases operated	4	3	2	5	4	1	2	
Radius	15	..	Cases not operated	..	..	..	..	..	..	..	Time of treatment, unstated.
Ulna	..	13	Cases operated	5	2	0	4	0	2	0	
Ulna	6	..	Cases not operated	..	..	..	..	..	..	..	Time of treatment, unstated.
Radius and ulna	..	54	Cases operated	17	12	5	5	5	3	1	
Radius and ulna	29	..	Cases not operated	..	..	..	..	..	..	..	Time of treatment, unstated.
Femur	..	143	Cases operated	43	26	4	14	21	9	23	
Femur	..	74	Cases operated	..	..	..	..	..	..	..	12 early, 52 late.
Femur	360	..	Cases not operated	..	..	..	..	..	..	..	Time of treatment, unstated.
Femur	140	..	Cases not operated	..	..	..	..	..	..	..	Time of treatment, unstated.
Tibia	..	18	Cases operated	9	1	2	0	3	2	0	
Tibia	20	..	Cases not operated	..	..	..	..	..	..	..	Time of treatment, unstated.
Fibula	..	2	Cases operated	1	1						
Fibula	29	..	Cases not operated	..	..	..	..	..	..	..	Time of treatment, unstated.
Tibia and fibula	..	47	Cases operated	16	2	3	2	8	4	8	
Tibia and fibula	59	..	Cases not operated	..	..	..	..	..	..	..	Time of treatment, unstated.
Total	704	444		119	61	20	38	46	25	37	

The above analysis shows the cases not operated on have a larger percentage of good anatomical results, but the percentage of the good functional results is decidedly higher in the patients operated on, except in compound fractures of both bones of the leg; here the reverse is true.

An attempt to find out the average period of disability for compound fractures of the several bones in the various regions failed because the records rarely included this important item. Likewise the note as to whether the patient was able to return to his former job was so rarely made that this question failed.

The reporter's own cases, totaling 51, showed disability when the patient returned to work: from compound fractures of the bones of upper extremity, four months; compound fractures of femur, thirteen months; and compound fractures of leg, six months. No marked difference was noted as regards disability between the non-operative and operative cases.

In the largest number of cases there was no statement as to the number of hours which elapsed between the hour the accident occurred and the hour the first treatment was applied.

Time Elapsing between Injury and Efficient Treatment

The following investigations (Tables XXXIII and XXXIV) refer to *simple fractures*.

In a series of 140 femurs it was stated that 70 were treated within the first twelve hours; 9 between thirteen and twenty-four hours; 4 between twenty-five and forty-eight hours; 4 between forty-nine and seventy-two hours, and 5 after seventy-three hours. In 48 cases the time was not stated.

It is thought that many of the unsatisfactory results following fractures are due to the fact that *too many hours elapse* between the time the fracture occurs and the time when the fracture is reduced and the first efficient splint is applied. In order to determine this it will be especially important to answer correctly questions 7 and 9 of the inquiry form for fractures (page 27).

From a collection of 143 femurs which were operated on it was possible to analyze more or less accurately a series of 103 cases

and thus learn whether or not prompt attention markedly affected their results:

37 were children up to fifteen years. 11 were operated on within seven days and secured normal function; 13 within fourteen days with normal function; 5 within twenty-one days with normal function; whereas 8 who were operated on after the twenty-eighth day recovered only moderate function. Of the whole 37 patients, the results were 80 per cent. good function, 20 per cent. moderate function.

14 cases between sixteen and twenty-five years. 6 were operated on within seven days and secured normal function; whereas 8 were operated on later recovered only moderate function. Of the whole 14 patients, 43 per cent. secured good function, 57 per cent. moderate function.

29 cases between twenty-six and forty-five years. 10 operated on within fourteen days recovered normal function; 1 case operated on within twenty-one days secured normal function; whereas 20 operated on later secured only moderate function in 18 and bad function in 2. Of the whole 29 patients, 37 per cent. secured good function, 62 per cent. moderate function, 1 per cent. bad function.

23 cases over forty-five years. 3 only secured good function and all were operated on within fourteen days. Six additional cases operated on within fourteen days secured only moderate function; 14 operated on later than fourteen days recovered only moderate function in 10 and bad function in 4. Of the whole 23 patients, 13 per cent. secured good function, 70 per cent. moderate function, 17 per cent. bad function.

It can easily be seen from the above that normal function is recovered in a larger number of cases when operation is done promptly (within fourteen days) than when operation is postponed until later; also, that the percentage of recovery of normal function diminishes as age advances.

In the 103 cases good anatomical position was secured in 71 cases (about 70 per cent.), whereas good function was obtained in only 50 cases (about 50 per cent.). This corresponds with the facts that only 52 cases were operated on within fourteen days and 51 cases later than twenty-one days.

When operation is postponed longer than about fourteen days; the bones may still be brought into good position, but on account of injury or disuse of the muscles and soft parts for longer periods, good function has seldom been obtained.

TABLE XXXIV.—INFLUENCE ON RESULT OF TIME ELAPSING BETWEEN INJURY AND OPERATION (FEMUR)

Ages, years.						Date of operation, days.					Anatomical position.			Functional result.		
5 to 10	11 to 15	16 to 20	21 to 25	26 to 45	46 +	0 to 7	8 to 14	15 to 21	22 to 28	29 +	Good.	Moderate.	Bad.	Good.	Moderate.	Bad.
23						8	7	1	2	3 2	8 7 1 2 3	2		8 7 1 2	3 2	
	14					3	6	2		1 2	3 6 2 1	2		3 6 2	1 2	
		6				3				1 1 1	3 1	2 1 1		3	1 1 1	
			8			3 1 1				2 1	3 1 2	1 1		3	1 1 2 1	
				29		6	4 1	1 1	1	1 4 8 2	6 4 1 1 1 1 4	1 8 2		6 4 1	1 1 1 4 8	2
					23	2 1 3	1 2	1		3 1 6 1 2	2 1 2 1 3 3 1	1 3 6 1	2	2 1	3 2 1 3 6	1 1 1 2
103 cases						31	21	6	3	42	71	30	2	50	46	7

REPORT OF 1916

COMMITTEE

Dr. John B. Walker
Dr. Thomas W. Huntington
Dr. Edward Martin
Dr. Astley P. C. Ashhurst
Dr. W. L. Estes
Chairman

Synopsis. Form of record and schedule adopted by railroad companies and societies.

According to the program and the directions contained in the Resolution adopted by the Association at its last annual meeting, the Committee on Fractures has this year only made preparation for its final report.

As the Association recommended, the form of record and schedule of fractures adopted by the Association last year were presented to and adopted by the Surgical Section of the American Medical Association, were sent to all the principal railroads and industrial establishments of the East and Middle West, and the standard form of record was adopted by most of them. It was also formally adopted by the New York and New England Association of Railway Surgeons, by the National Conference on First Aid, by the Pennsylvania Railroad Surgical Association, by the Medical Society of the State of Pennsylvania, by the Medical Department of the United States Army, and by the United States Public Health Department.

Besides these organizations, a number of industrial corporations and hospitals have taken the blanks as their models and have furnished their institutions with similar blanks.

The Committee has sent out to date 7500 of these blank reports.

The general adoption of these forms is encouraging, but it will do little good unless the records are faithfully kept, and unless these records, when properly completed after the patients have

returned to work, are sent to the committee for analysis and included in its final report to this Association.

The Committee begs, therefore, every Fellow of this Association to use his influence and efforts constantly to see that these reports be kept faithfully and fully, and to have copies sent to the Committee when the records are completed.

The Committee will endeavor from this time on to collect and collate these reports, and hopes next year to be able to make its final report.

REPORT OF 1917

COMMITTEE

Dr. John B. Walker
Dr. Thomas W. Huntington
Dr. Edward Martin
Dr. Astley P. C. Ashhurst
Dr. W. L. Estes
Chairman

Though the Committee sent out 6850 copies of the official blank for collecting data, and directly or through the assistance of the associate members throughout the United States and Canada enlisted the promised help of many hospitals and a large number of industrial establishments and railroads, the chairman received only 79 reports from these establishments and railroads.

The Surgeon-Generals of the Army and Public Service Department also adopted the form, and from these services 149 reports were received.

The several members of the committee have collected from their own services and hospital connections something like 350 reports.

Obviously these data are not sufficient upon which to base the conclusive standardization for which the committee is working.

The Workmen's Compensation Board of Pennsylvania has officially adopted the Association's forms of report, and has agreed to give the committee the benefit of its collection.

By persistent effort through another year hospital surgeons and hospital managements may be induced so to record their cases of fractures that your committee may receive sufficient data to make a final report, one of value and importance.

The committee therefore reports progress, and leaves to the Association the determination as to whether or not the committee shall be continued.

REPORT OF 1918

COMMITTEE

Dr. John B. Walker
Dr. Thomas W. Huntington
Dr. Edward Martin
Dr. Astley P. C. Ashhurst
Dr. W. L. Estes
Chairman

It will be recalled that in its preliminary report in 1915 it was stated by the committee that it had set itself the task of trying to determine three points in regard to fractures of the long bones, namely:

1. To find out the average present-day result in both simple and compound fractures, as regards anatomical and functional results, in the several age groups and the average time of disability. This latter period is determined to mean the average time the patient lost from work or from his ordinary duties.

2. The comparative value of (*a*) the conservative or closed methods, and (*b*) the operative or open methods.

3. The comparative value of immediate or delayed treatment in each group of cases.

To carry out this plan it was necessary to obtain and to analyze a large number of well-kept and fully registered fracture records.

The committee based its preliminary report on 1745 collected and investigated cases. The records of these cases, however, were so incomplete and unsatisfactory that for some of the points entirely too little data were obtained to form the basis for conclusions. In order to overcome this difficulty the committee recommended to this Association a standard form for the record and preservation of fracture data, requested that it be made the official form of the Association, and that it be adopted by all Fellows of this Association and by the hospitals with which they were connected.

The Association adopted the form. It was also adopted by the surgical section of the American Medical Association, by several

State medical societies, by the U. S. Army Medical Department, by the Compensation Board of Pennsylvania and by numerous hospitals and associations.

The chairman sent out several thousand copies of these forms to the various associations, societies, departments, hospitals and individuals. The net results have been the reception of reports of 327 additional cases up to date. Of these, many were so incompletely filled out that they were useless.

The committee feels, therefore, that with so few additional data it can offer to the Association very little more toward the standardization of the treatment and the average time of disability of fractures of the several regions of the long bones in the several age periods than it did in the preliminary report.

The little additional evidence, all of which has been worked out, except a few cases left over, by a Fellow who is in active military service, goes to confirm the conclusions of the preliminary report. The committee finds:

1. The results are best in the age period under fifteen years. Conservative treatment is generally effectual during this period.

2. Good anatomical restitution of a fractured long bone always results in the best functional result and has the shortest period of disability.

3. While few open operations are reported under the fifteen-year age period, it seems to make little difference in the results, except in senile cases (where it is unfavorable), what the age period is when the operation is done.

4. The end-results of non-operative and operative treatment of compound fractures show very little difference in the anatomical result, but the functional results are better after operative treatment,[1] except in compound fractures of the shafts of both bones of the leg; here the reverse seems to be true.

The age period, except in senile cases, has no marked effect on the result of the treatment.

[1] The period of disability is, however, longer by three or four weeks.

5. The average period of disability (that is, the time lost from work) in simple fractures is as follows:

For fracture of the shaft of the humerus	14.0 weeks
For fracture at the head and neck of the humerus .	11.5 "
For fracture at condyles of the humerus	9.0 "
For fracture of the shaft of both bones of the forearm	10.8 "
For fracture of the femur, all sites	6.2 months
For fracture of the leg, all sites	4.9 "

NOTE.—This determination must still be held as not quite conclusive on account of the comparatively few clear reports on this point. The chairman has verified these disability periods in something less than 100 of his own cases and finds them substantially correct.

Periods of disability were not recorded accurately in the majority of the reported cases and very seldom in compound fractures.

For compound fractures the average period of disability is as follows:

For fractures of the femur	13 months
For fractures of the leg	6 "
For fractures of the upper extremity	4 "

6. The humerus should show not more than 1 cm. shortening and no appreciable angulation. Musculospiral paralysis should not result.

The forearm bones should show no appreciable shortening and pronation and supination should be unhindered. Function should always be good and no lasting pain result.

Fracture of the shaft of the femur should not result in shortening greater than 2 cm., nor in a fixed position of angulation or rotation which will affect the joints and require new habits of balancing or tilting of the pelvis; joint function should be good. No permanent disability of the affected member should result. Fracture of the shaft of the bones of the leg should result in no appreciable shortening and no angulation or rotation. Joint function should be preserved.

7. There is no method or splint universally applicable, nor has any given splint or apparatus proved its superiority. All depends upon the discrimination of the surgeon and the manner in which the apparatus is applied and maintained.

It is evident that traction methods are most frequently unskilfully employed. As a rule, too little weight is used. The gauge of the proper weight required is that necessary to overcome the shortening. This should be determined by careful daily measurement. Traction methods require, as a rule, counter-traction.

Plaster casts and molded splints are especially indicated and useful after a fracture has been satisfactorily reduced.

REPORT OF 1921

THE FINAL REPORT.

By W. L. ESTES, M.D., Chairman
BETHLEHEM, PA.

The committee presents its final report. This report is the completion of the 1915 report and may be received as a combination of the preliminary 1915 report with subsequent investigation and later data.

The same general scheme of investigation as was indicated in the 1915 report has been followed, namely:

1. Only fractures of the long bones have been studied.
2. The same regions or divisions of the bones have been noted.
3. Simple and compound fractures have been separately classified, investigated and tabulated.

The four main points of inquiry and investigation have been continued, namely:

1. What is the average present-day anatomical and functional results in both simple and compound fractures in the several age groups?
2. What is the average period of disability of (*a*) simple and (*b*) compound fractures of the several long bones?
3. What is the comparative value of (*a*) the non-operative or closed methods and (*b*) the operative or open methods?
4. What is the comparative success of immediate and delayed treatment in each group of cases?

The blank form recommended by the committee has been slightly changed. It was formally adopted by this Association, recognized by the American College of Surgeons and has been introduced into many hospitals in the United States as the accepted blank for recording fracture data. Its continued and regular use

in the hospitals will result in having available for future investigation adquate records of fractures, and we hope will induce surgeons to see to it that their fracture cases shall always be followed up and the final results accurately determined and noted.

FRACTURE RECORD

American Surgical Association

General Results:	GOOD	MODERATE	BAD
Anatomical			
Functional			

1. Bone.....
2. Site—Neck.....Upper.....Middle.....Lower 3d.....Condyle.....
   Involving joint .....

---

3. Name.....
4. Sex—M.....F.....
5. Age.....
6. Occupation.....
7. Time fracture occurred—Date.....Hour.....
8. Hospital entered—Date.....Hour.....
9. First treatment—Date.....Hour.....
10. Cause of fracture.....
11. Kind of fracture—Oblique.....Transverse.....Spiral.....
    Impacted.....Comminuted.....Simple.....Compound.....
    Greenstick.....Subperiosteal.....
12. Was there serious injury to soft parts—Skin—Yes.....No.....
    Muscles—Yes.....No..... Vessels—Yes.....No.....
    Nerves—Yes.....No.....
13. Reduction: How many hours elapsed after accident before reduction.....
14. Was anatomical reposition of fragments obtained—Yes.....No.....
15. Anesthetic used: Yes.....No..... Ether.....Gas.....
16. Fixation: Closed Method.
    Position—Hyperflexion.....full supination.....abduction.....
    Splints.....
    Plaster of Paris.....
    Traction—Buck.....Thomas.....Hodgen.....
    Balkan frame.....Tongs.....
    Amount of weight used.....

17. Fixation: Open Method.
Was non-operative treatment tried first.....
How long after injury was operation performed.....
Was open reduction alone performed
What form of internal fixation used—Steel plates.....Wire.....
Nails.....Screws.....Bone transplants or implants.....
Was it later necessary to remove fixation materials—Yes.....
No..... Date.....
18. Shortening at first examination.....cm.
When all apparatus removed.....cm. Date.....
When discharged from hospital.....cm. Date.....
At last observation.....cm. Date.....
19. Roentgen ray used—Yes.....No..... First finding—Date.....
day before reduction; .....day after reduction

Plate No.	Fragments displaced, date.	Not.	Slightly.	Markedly.	Overriding.	Rotation.	Angulation.
	Before reduction						
	After reduction						
	After union						

20. How long confined in bed..... How long in hospital.....
21. How long did patient use crutches.....Cane.....
22. Results: Final examination made.....weeks.....months after injury.
Union: Bony.....Fibrous.....Non-union.....
23. Disability: Absent.....Partial.....Complete.....
Estimated by.....Shortening.....Angulation.....
Swelling of soft parts.....Pain.....Nerve involvement.....
Interference with joint function.....Endurance.....
24. Mortality—Main cause of death.....Age of patient.....Shock.....
Hemorrhage.....Other injuries.....Sepsis.....Exhaustion.....
25. Duration of absence from work.....weeks.....months.....
26. Is patient fully able to take his former job.....
27. Present wage-earning capacity compared with former.....
28. Compensation under insurance, legislative act or legal process obtained—
Yes.....No..... Expected—Yes.....No.....

The investigation on account of the difficulty in securing reports and the necessity of searching through many incomplete reports in order to find adequate data has proved onerous and trying. In order to lighten the labor and to obtain the best results the committee was divided and a certain part of the work assigned to each as follows:

1. To Dr. J. B. Walker was assigned the investigation and report of fractures of the A. E. F. during the war, with ultimate results.

2. To Dr. T. W. Huntington the fractures of the humerus in civil life.

3. To Dr. Edward Martin the fractures of the bones of the forearm in civil life.

4. To Dr. A. P. C. Ashhurst the fractures of the bones of the leg in civil life.

5. To Dr. W. L. Estes the fractures of the femur in civil life.

Each head of a division will therefore make a report of his investigation of the fractures belonging to his division and should receive full credit for his work.

The following-named Fellows served as the auxiliary committee and rendered valuable service in assisting, collecting and examining cases. Divided into groups a certain number were assigned to each division and assisted in drafting and formulating the reports of the several divisions.

Dr. Walker: Fractures in War. Assistants: Dr. Jones, Dr. Matas, Dr. Starr.

Dr. Huntington: Fractures of the Humerus. Assistants: Dr. Jonas, Dr. Freeman, Dr. Terry.

Dr. Martin: Fractures of the Bones of the Forearm. Assistants: Dr. Thompson, Dr. Ransohoff.

Dr. Ashhurst: Fractures of the Bones of the Leg. Assistants: Dr. Speed, Dr. Gaub.

Dr. Estes: Fractures of the Femur. Assistants: Dr. Graham, Dr. Vaughan.

We gratefully acknowledge their valuable assistance in preparing this report.

First Division. Military fractures, 2083 cases.

Second Division. Fractures of the humerus, 162 cases: non-operative, 117; operative, 45.

Third Division. Fractures of the bones of the forearm, 271 cases: non-operative, 227; operative, 44.

Fourth Division. Fractures of the leg bones, 926 cases: non-operative, 739; operative, 187.

Fifth Division. Fractures of the femur, 654 cases: non-operative, 471; operative, 183.

Altogether the committee collected and studied over 8000 cases of military fractures and 2013 cases in civil life. Of these civil cases 1521 were simple fractures and 482 compound. The results of all these cases have been carefully investigated.

Unfortunately the records of many of the cases were so incomplete that they could not be used in their entirety.

The cases have been tabulated under six principal heads, namely:

1. To show the results in the following age periods, viz.: (*a*) One to fifteen years; (*b*) fifteen to forty-five years; (*c*) forty-five to sixty years; (*d*) over sixty years.

2. To show the effect of good anatomical restitution in shortening the period of disability and restoring full function.

3. To show comparative results in the treatment of simple fractures of the operative (open) method and the non-operative (closed) method in the several age groups.

4. To show the result of the operative and non-operative methods in the treatment of compound fractures, also considered as regards the several age groups.

5. To show the results of treatment of the fractures of the several long bones in the various regions in the several age groups, in order to determine the average period of recovery.

6. To show the comparative results of immediate and delayed treatment of the closed and open methods of treatment in the several age groups.

The operative cases are considered as:

1. Immediate.
2. Delayed.

All operations performed within fourteen days after injury are classed under immediate operations; those done after this period are classed as delayed operations.

The results of operations for non-union and for deformities

resulting from fractures are not included nor considered in the report at all.

The committee finds:

1. The results are best in the age period under fifteen years. Conservative treatment is generally effectual during this period.

2. Good anatomical restitution of a fractured long bone results in the best functional result and has the shortest period of disability.

3. While comparatively few open operations are reported under the fifteen-year-age period it seems to make little difference in the result, except in senile cases (where it is unfavorable), what the age period is when the operation is done.

4. The end-results of non-operative and operative treatment of compound fractures show very little difference in the anatomical result, but the functional results are better after operative treatment, except in compound fractures of the shafts of both bones of the leg; here the reverse seems to be true.

5. The average period of disability (that is the time lost from work) in simple fractures is as follows:

For fracture of the shaft of the humerus	14.0 weeks
For fracture of the head and neck of the humerus .	11.5 "
For fracture of the condyles of the humerus . . .	9.0 "
For fracture of the shaft of both bones of the forearm	10.8 "
For fracture of the femur, all sites, adult cases . .	8.2 months
For fracture of the femur, all sites, children . . .	4.5 "
For fracture of the leg, all sites	4.7 "

(Periods of disability were not recorded accurately in many of the reported cases and very seldom in compound fractures.)

Compound Fractures

For fractures of the femur	11.0 months
For fractures of the leg	7.0 "
For fractures of the upper extremity	4.0 "

6. For good functional results the humerus should show not more than 1 cm. shortening and no appreciable angulation. No pain or paralysis should result.

The forearm bones should show no shortening; function should always be good and no lasting pain result.

Fracture of the shaft of the femur should not result in shortening greater than 2 cm., nor in a fixed position of angulation or rotation. The function of all joints should be good.

Fracture of the shaft of the bones of the leg should result in no appreciable shortening and no angulation or rotation. All function of the joints should be preserved.

7. There is no method or splint universally applicable; all depends upon the discrimination of the surgeon and the manner in which the apparatus is applied and maintained.

The late war has brought into prominence the suspension-traction method for treating fractures. The Balkan frame or the Hodgen splint for suspension is used, and tongs or the Steinmann nail are used for traction directly on the distal fragment. The Thomas splint has proved of great value in the treatment of fractures of the shaft of the femur; it is recommended especially when hospital treatment cannot be obtained.

Plaster casts and molded splints are indicated and are useful only after a fracture has been satisfactorily reduced.

RECOMMENDATIONS. 1. The committee recommends as a general principle that fractures be treated by a skilled surgeon.

2. Roentgen-ray pictures should be made by a competent radiographer and a fluoroscope should be used for diagnostic purposes and for guidance in applying the permanent dressing. At least two skiagrams should be taken, and they should be taken from opposite perpendicular directions. Skiagrams should also be taken after permanent dressings are applied, to prove proper reduction, and at the end of treatment to show the results of the union and for the purpose of a graphic record.

3. Fractures should be reduced immediately after the injury if it is possible to obtain and apply proper retaining apparatus or splints. The statistics show markedly better results when the treatment is begun at once. It is, however, not only useless but cruel to subject the patient to the pain of manipulation for reduction unless the surgeon has proper fixation apparatus at

hand and the subject is where he may have a permanent dressing applied.

4. General anesthesia should be employed, as a rule, to facilitate reduction and to prevent pain, unless the condition of the patient contraindicates it.

5. Neither the non-operative nor the operative method is to be recommended exclusively. Each has its indications and should be employed when required. Generally speaking the age period under fifteen years is the period in which non-operative methods are especially effectual.

6. The open method when adopted should be employed early. It may be used at any age period, except in senile cases, whenever a skiagram shows a deformity or a position of the fragments which obviously cannot be reduced or when proper efforts at reduction and retention have proved unavailing.

7. Some form of rigid plate applied directly to the bone seems to be the best fixation method in operative cases.

8. Open operations for simple fractures should be undertaken only by experienced surgeons who are thoroughly equipped by training and who have proper instruments and apparatus to meet all the possible indications of the operation.

9. After fracture of the long bones of the lower extremity, some efficient form of caliper should be used when the patient begins to walk, and should be continued for some weeks, in order to prevent yielding of the newly united fragments to the weight of the body and the production of bending and distortion at the seat of fracture.

10. The treatment of any fracture ought not to be considered complete until full restitution of function has been secured. For this purpose every hospital which treats fractures should be equipped with apparatus for mechanical, electrical and hydropathic treatment. The reconstructive treatment should be considered in every case an essential part of the general treatment. Also, in order to make the record of every case of major fracture complete a careful follow-up system should be adopted and sedulously followed.

11. The work of this committee has been greatly hampered by the inadequacy of the records submitted for its consideration. A large proportion of the cases had to be rejected entirely, and most of them were so incomplete as to make deductions based upon them misleading.

The first step in the betterment of practice is the study of results achieved by present-day methods. An adequate study is impossible without complete records.

FRACTURES IN MILITARY SERVICE.

By JOHN B. WALKER, M.D.
NEW YORK

Among the 224,089 battle casualties in the A. E. F. there were 27,013 patients, with 18,639 fractures involving the long bones: 5063 occurred in the femur, 4254 in the humerus, 1066 in the fibula, 2679 in the tibia, 1945 tibia and fibula, 1527 in the radius, 1225 in the ulna, 801 radius and ulna, 79 not stated.

The most serious cases were the gunshot fractures of the femur, and it was in just this class that there developed the greatest improvement in the treatment of fractures during the World War. Of the 5063 patients with this fracture, 1010 (20 per cent) died; while in the Civil War, of the 6738 fractured femurs, 3434 (50 per cent) died. Of the above 1010 deaths, 40 per cent died within the first seventy-two hours and 55 per cent within the first seven days.

Treatment. Infection to some degree was present practically always; generally it was severe and persistent. Osteomyelitis became the most serious complication. Those cases in which the primary operative work was thoroughly performed within the first twelve hours made by far the best recovery. In those cases which were operated on after twenty-four hours the percentage of infection and mortality was more than doubled.

Amputation. 833 femurs were amputated and 218 (26 per cent) died. It is generally believed that the earlier the amputation the lower the mortality, but as yet it has been impossible to secure from the Surgeon-General's office sufficiently accurate data upon this question, in the majority of cases the time of operation was not recorded.

Splints. The Thomas splint was generally applied in the front lines and many fractured femurs received the additional benefit of suspension traction in the Balkan frame, for a time, in some one of the different hospitals through which they passed. Later, when ready for transportation to the United States, plaster casts were applied and many remained unchanged for a longer period than necessary, thus predisposing to joint stiffness. Consequently, the good or bad result obtained in many cases could not be attributed to any special method, as the fractures had been treated by so many various methods.

While in many cases the Thomas splint was not used efficiently, as it did not fit well, and the so-called extension straps were rarely found tight enough, nevertheless it is universally conceded to have proven by far the best method of treatment.

Suspension-traction, when accurately applied and efficiently maintained, produced really wonderful results, such as had not been generally believed possible before the World War, as Page, Pierson, Sinclair, Blake, Depage and Tuffier and others have demonstrated.

Statistics. From the 5063 fractured femurs, 158 (3.12 per cent) returned to duty in the army.

March 1, 1919, reports in the Surgeon-General's office indicated that a prognosis could be made that 76 per cent of fractures of long bones would recover with satisfactory function. How widely this has varied is seen by the follow-up reports of the Bureau of War Risk over two years later, May 1, 1921, when it was found that 70 per cent of fractures were suffering a disability of at least 20 per cent. Only 4 per cent have been reported, with a disability of less than 10 per cent.

Femurs. Of 2306 cases recorded in the Bureau of War Risk June 1, 1921, 83 per cent are suffering with a disability of 20 per cent or more; 0.02 per cent have less than 10 per cent disability.

Shortening is variable, but generally least when the Thomas or the Hodgen splint was well applied and suspended from the Balkan frame. It was reported that there was no shortening in 18 per cent. I think this is doubtful, and more careful measurements

will show some shortening; 14 per cent had shortening of one-half to one inch; 72 per cent had shortening of one and a quarter inches or more.

Bowing. Outward bowing and marked deformity has occurred in many cases after union had been thought to be firm. This has occurred more often in the United States patients than among the British, who customarily wear a walking caliper splint for a considerable period.

Refracture has also occurred more frequently than is generally appreciated, and again more often with our patients than with the British. This accident, generally preventable, furnishes an additional reason for applying a walking caliper as soon as the patient leaves his bed to begin walking. Walking calipers have seldom been used by our patients.

Duration in Hospital. Five per cent of cases were discharged under three hundred days, 24 per cent under four hundred days, and 76 per cent required hospital treatment for more than four hundred days. This last figure varies considerably from that of three hundred and eight days as estimated from the records in the Surgeon-General's office—another illustration of the great difficulties in comparing records for the purpose of establishing standards for duration of disability.

During 1917, 1918 and 1919 there occurred in the United States Army, either in the United States or in the A. E. F., accidental fractures other than battle fractures.

Compound Fractures: 9449 cases required hospital treatment, with an average of sixty-nine days; 683 were femur fractures and required hospital treatment for an average of one hundred and five days.

Simple Fractures: 43,497 cases required an average of forty days' hospital treatment; 1531 were femur fractures, which required hospital treatment for an average of eighty-nine days.

Duration of Disability. When one consults the British fracture report to learn the period of disability for fractures of the femur he finds it is two hundred and thirty-one days; the American Fracture Committee gives two hundred and seventeen days;

the New York State Compensation gives one hundred and sixty-nine days; the United States Employers' Commission gives one hundred and fifty-two days; the United States Surgeon-General's Office gives eighty-nine days.

Compound Fractures of the Femur: Accidental, Surgeon-General's Office, one hundred and five days; battle injuries, three hundred and eight days; Bureau of War Risk, over four hundred days.

Non-union. Thus far there have been 906 cases reported: Humerus, 164; radius, 178; ulna, 120; radius and ulna, 71; femur, 155; tibia, 132; fibula, 9; tibia and fibula, 77. Bone grafts were used in 611 cases; Lane plates in 189; suture and wire in 52; kangaroo tendon or chromic gut in 54.

Grafts were taken from the tibia in 358 cases, and in 98 cases a sliding graft was employed; in 25 cases pegs made from beef bone were used, and in 31 cases pieces of rib.

Grafts: Autogenous, taken from the tibia, have proven the most efficient material for fractures of the long bones, on account of its characteristic strength. They are best made with the saw, and exact coaptation of the parts of the graft to respective parts of the host bone must be secured. Where many of these records are as yet too incomplete to give the final end-results, yet sufficient evidence has been secured to prove that bone-grafting is the most efficient method of treatment for non-union of fractures, and favorable results can be obtained in the largest percentage of cases.

Conclusions. The earliest possible reduction of a fracture is imperative. The suspension-traction method secures the best results in fractures of the long bones, and especially in the femur. It is easily adjusted; wounds of the thigh can be readily exposed for dressings; both the wounds and the fracture can be properly treated together without disturbing the satisfactory reduction of the fracture that is preserving the immovableness of the fragments. "It secures relaxation of the deforming muscles and so permits the bone fragments to fall into their proper relation." It permits mobilization of the joints of the part from the first

moment of beginning treatment and thus secures prompt recovery with preservation of function.

Fractures of the lower third with displacement are best treated by *skeletal* traction, with non-penetrating calipers above the knee, combined with early movement of the joints, hip, knee and ankle.

One of the most important lessons learned is the great *emphasis* placed upon *ultimate function* in the individual rather than on restoration of the contour and anatomical structure of a part. The former idea that marked deformity and disability are inevitable in fractures must be abandoned. In the past, surgeons have failed to devote the care which these most serious cases demanded. Putting into actual practice the methods which were demonstrated the best, especially in the last year of the World War, convalescence will be shortened, compensation reduced and the injured returned to his former occupation with a saving of 25 to 50 per cent of the time now lost—an enormous saving to industry.

Page and LeMeseurier secured excellent results in 125 cases of fracture of the femur with an average shortening of 0.37 inch.

Pierson, in 68 cases, had no shortening in 29; 29 additional cases averaged 1.5 cm. shortening; mobility of the hip and the ankle were in almost all cases normal; in the knee, 55 had a range of flexion over 90 degree 10 had a range of between 60 degree and 90 degree and 3 ranged between 30 degree and 60 degree.

Bohler had 54 cases, in which the average shortening did not exceed one-half inch.

Erlacker and Zollinger reported equally good results.

Methods of treatment should be standardized and then universally employed. Conventional treatment is now inadequate. "There is no standard to which the advocate of efficiency may appeal; no incentive to energy, nor penalty for incompetence." In the past inefficiency has been tolerated; hereafter the surgeon who applies inadequate methods will be held responsible for failure. Jones states, "The question of fracture of the femur is essentially one of preventable surgery," dependent upon (1)

efficient fixation of the fracture with as correct alignment as possible, and (2) early and frequent movements of the neighboring joints.

Recommendations. The general adoption of the standard forms of splints used in the A. E. F.

General use of suspension-traction methods, employing the Hodgen or Thomas splints with the Balkan frame. Systematic and frequent *x*-ray examinations and mensuration to control the position of the fragments. Films should be taken as often as once every two weeks until firm union occurs. A portable *x*-ray outfit and a fracture table should be installed in every hospital where fractures are treated.

Physiotherapeutic massage and electrical treatment should be employed in every case at the earliest date.

Every femur case should wear a walking caliper when out of bed until union is solid.

Standard fracture records should be used in every case, and the greatest improvement in the treatment of fractures will result. Wherever these have been used there fractures have received the best treatment. The importance of using follow-up reports cannot be exaggerated.

Medical schools should give more clinical instruction in hospital wards in the actual detailed care of fractures.

One of the most valuable lessons learned from the World War was clearly demonstrated in the British and the United States A. E. F. hospitals, that where fractures were concentrated under one control in special services there the best results followed. It is firmly believed that civil hospitals should be so reorganized that fractures can be concentrated in special fracture services associated with a well-equipped physiotherapeutic department and that thereafter great improvement will result. Wherever this plan has been developed it has proven wise, as in the Massachusetts General, Montreal General and Bellevue hospitals.

According to Hoffa, two-thirds of all accident claims are based upon the consequence of fractures. Increased efforts must be made to so treat fractures as to obtain good functional

results in a larger number of cases. Economically it is the soundest business for the individual and for the state to get a perfect result in a young man. An imperfect cure makes a man face difficulties in finding employment and results in the permanent charge to the state of an unproductive, subsidized and discontented citizen.

SIMPLE FRACTURES OF THE HUMERUS[1]

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TABLE I shows that 38 per cent. of the cases of fractures of the humerus were treated by the operative method. This is probably an indication that anatomical reduction of these fractures without the assistance of vision directly upon the fragments is very difficult in a large number of cases.

Table III shows that 70 per cent. of the non-operative cases were followed by good anatomical results, and that when this was obtained 95 per cent. of the cases had good functional results and only a little over 1 per cent. had bad functional results. When only moderate anatomical results were obtained there followed barely 68 per cent. of good functional results.

This emphasizes the importance and value of good anatomical results in all cases of fracture of the humerus. (See Table IX.)

Table VIII indicates that fracture of the upper and lower extremities (the head and condyle) of the humerus required the greater number of operations, but even after operative treatment the anatomical results in these regions were not as good as by the non-operative treatment. The functional results were not nearly as good by the operative as by the non-operative treatment.

In Table V only a very small group could be obtained for the study of the influence of age upon the functional results. While the actual percentages would show the senile age period, viz., over sixty years, had better functional results than the 1 to 15 year

[1] The conclusions and data worked out by the Chairman.

period, the group is too small to disprove the general rule that children under fifteen years of age have better functional results after fractures than do those over fifteen years of age. The operative group in age periods is entirely too small for one to draw any definite conclusions.

In Table IX is shown that good anatomical results are followed in 79 per cent. of the cases by the shortest disability.

It is interesting to note that two cases, one an individual in the 1 to 15 age period and the other in the 45 to 60 period, notwithstanding a bad anatomical result, are rated among the cases of shortest disability. These anomalies are certainly exceptions, and apart from the fact that there are only two cases out of thirty-six, it is shown in Table X that the 45 to 60 age period cases had bad functional results and should doubtless be classed as permanently disabled.

In a group of thirty-six cases the average disability of the age period 1 to 15 years is three months, average of all age periods over 1 to 15 years is eight months, but of these 52 per cent. were reported to have a disability under three months.

Compound Fractures of the Humerus. In this group the number of cases is too small for any deductions. A little more than twice as many of the cases were treated by the operative as by the non-operative method. The tables suffice to show the various divisions of the study and the conclusions so far as they may be drawn from the small number of cases.

Simple Fractures of the Humerus

TABLE I

	Total.	Non-operative.	Operative.
Humerus, shoulder	42	26	16
Humerus, shaft	42	30	12
Humerus, elbow	78	61	17
	162	117	45

In the following tables the fraction percentages are not worked out:

TABLE II

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
Good . . .	116 (71%)	97 (83%)	15 (12%)	4 (3%)
Moderate . .	38 (23%)	21 (55%)	15 (39%)	2 (5%)
Bad	8 (4%)	3 (37%)	2 (25%)	3 (37%)
	162 (98%)	121 (74%)	32 (19%)	9 (5%)

TABLE III.—NON-OPERATIVE

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
Good . . .	82 (70%)	78 (95%)	3 (3%)	1 (1%)
Moderate . .	29 (24%)	20 (68%)	8 (27%)	1 (3%)
Bad	6 (5%)	3 (50%)	2 (33%)	1 (16%)
	117 (99%)	101 (86%)	13 (11%)	3 (2%)

TABLE IV.—OPERATIVE

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
Good . . .	34 (75%)	19 (55%)	12 (35%)	3 (6%)
Moderate . .	9 (20%)	1 (11%)	7 (77%)	1 (11%)
Bad	2 (4%)	0	0	2 (100%)
	45 (99%)	20 (44%)	19 (42%)	6 (13%)

TABLE V.—INFLUENCE OF AGE ON THE FUNCTIONAL RESULTS

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
1 to 15 years:				
Good . .	8 (72%)	7 (87%)	1 (12%)	0
Moderate .	2 (18%)	1 (50%)	0	1 (50%)
Bad . . .	1 (9%)	1 (100%)	0	0
	11 (99%)	9 (81%)	1 (9%)	1 (9%)
15 to 45 years:				
Good . . .	10 (90%)	7 (70%)	3 (30%)	0
Moderate .	1 (9%)	0	1 (100%)	0
Bad . . .	0 (0%)	0	0	0
	11 (99%)	7 (63%)	4 (36%)	0
45 to 60 years:				
Good . .	6 (75%)	4 (66%)	2 (33%)	0
Moderate .	1 (12%)	1 (100%)	0	0
Bad . . .	1 (12%)	1 (100%)	0	0
	8 (99%)	6 (75%)	2 (25%)	0

Over 60 years:				
Good . .	5 (83%)	5 (100%)	0	0
Moderate .	1 (16%)	0	1 (100%)	0
Bad . . .	0	0	0	0
	6 (99%)	5 (83%)	1 (16%)	0
All over 15 years:				
Good . . .	21 (84%)	16 (76%)	5 (23%)	0
Moderate .	3 (8%)	1 (33%)	2 (66%)	0
Bad . . .	1 (4%)	0	0	1 (100%)
	25 (96%)	17 (68%)	7 (28%)	1 (4%)

TABLE VI.—INFLUENCE OF AGE ON NON-OPERATIVE TREATMENT

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
1 to 15 years:				
Good . . .	7 (70%)	7 (100%)	0	0
Moderate .	2 (20%)	2 (100%)	0	0
Bad . . .	1 (10%)	1 (100%)	0	0
	10 (100%)	10 (100%)	0	0
15 to 45 years:				
Good . .	7 (87%)	6 (85%)	1 (14%)	0
Moderate .	1 (12%)	0	1 (100%)	0
Bad . . .	0	0	0	0
	8 (99%)	6 (75%)	2 (25%)	0
45 to 60 years:				
Good . . .	4 (80%)	2 (50%)	2 (50%)	0
Moderate .	1 (20%)	1 (100%)	0	0
Bad . . .	0	0	0	0
	5 (100%)	3 (60%)	2 (40%)	0
Over 60 years:				
Good . . .	2 (66%)	2 (100%)	0	0
Moderate .	1 (33%)	0	1 (100%)	0
Bad . . .	0	0	0	0
	3 (99%)	2 (66%)	1 (33%)	0
All over 15 years:				
Good . . .	13 (81%)	10 (76%)	3 (23%)	0
Moderate .	3 (18%)	1 (33%)	2 (66%)	0
Bad . . .	0	0	0	0
	16 (99%)	11 (68%)	5 (31%)	0

TABLE VII.—INFLUENCE OF AGE ON OPERATIVE TREATMENT

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
1 to 15 years:				
Good	1 (100%)	0	1 (100%)	0
Moderate	0	0	0	0
Bad	0	0	0	0
	1 (100%)	0	1 (100%)	0
15 to 45 years:				
Good	3 (100%)	2 (66%)	1 (33%)	0
Moderate	0	0	0	0
Bad	0	0	0	0
	3 (100%)	2 (66%)	1 (33%)	0
5 to 60 years:				
Good	2 (100%)	2 (100%)	0	0
Moderate	0	0	0	0
Bad	0	0	0	0
	2 (100%)	2 (100%)	0	0
Over 60 years:				
Good	3 (100%)	2 (66%)	1 (33%)	0
Moderate	1 (25%)	0	1 (100%)	0
Bad	0	0	0	0
	4 (100%)	2 (50%)	2 (50%)	0
All over 15 years:				
Good	8 (88%)	6 (75%)	2 (25%)	0
Moderate	1 (11%)	0	1 (100%)	0
Bad	0	0	0	0
	9 (99%)	6 (66%)	3 (33%)	0

TABLE VIII

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
		NON-OPERATIVE		
Shoulder:				
Good	17 (65%)	16 (94%)	0	1 (5%)
Moderate	6 (23%)	4 (66%)	2 (33%)	0
Bad	3 (11%)	1 (33%)	2 (66%)	0
	26 (99%)	21 (81%)	4 (15%)	1 (3%)
		OPERATIVE		
Shoulder:				
Good	10 (62%)	7 (70%)	2 (20%)	1 (10%)
Moderate	5 (31%)	1 (20%)	4 (80%)	0
Bad	1 (6%)	0	0	1 (100%)
	16 (99%)	8 (50%)	6 (37%)	2 (12%)

Non-operative				
Shaft:				
Good . . .	18 (60%)	15 (83%)	3 (16%)	0
Moderate .	11 (36%)	7 (63%)	3 (27%)	1 (9%)
Bad . . .	1 (3%)	1 (100%)	0	0
	30 (99%)	23 (76%)	6 (20%)	1 (3%)
Operative				
Shaft:				
Good . . .	10 (83%)	4 (40%)	5 (50%)	1 (10%)
Moderate .	1 (8%)	0	1 (100%)	0
Bad . . .	1 (8%)	0	0	1 (100%)
	12 (99%)	4 (33%)	6 (50%)	2 (16%)
Non-operative				
Elbow:				
Good . . .	47 (77%)	47 (100%)	0	0
Moderate .	12 (19%)	9 (75%)	3 (25%)	0
Bad . . .	2 (3%)	1 (50%)	1 (50%)	0
	61 (99%)	57 (93%)	4 (6%)	0
Operative				
Elbow:				
Good . .	14 (82%)	8 (57%)	5 (35%)	1 (7%)
Moderate .	3 (17%)	0	2 (66%)	1 (33%)
Bad . . .	0	0	0	0
	17 (99%)	8 (47%)	7 (41%)	2 (11%)

TABLE IX.—DOES GOOD ANATOMICAL RESULTS LESSEN PERIOD OF DISABILITY?

Anatomical result.	Total.	Period of disability.				
		Under 3 months.	Under 6 months.	Under 9 months.	Under 12 months.	Over 12 months.
Humerus, all regions:						
Good . .	29 (81%)	23 (79%)	6 (20%)	0	0	0
Moderate .	5 (13%)	1 (20%)	4 (80%)	0	0	0
Bad . . .	2 (5%)	2 (100%)	0 (0%)	0	0	0
Total . . .	36 (100%)	26 (72%)	10 (27%)	0	0	0

TABLE X.—HUMERUS, ALL FORMS—36 CASES

	Anatomical result.	Total.	Period of disability and functional result.											
			Under 3 months.			Under 6 months.			Under 9 months.			Under 12 months.		
			Good.	Mod.	Bad.	Good.	Mod.	Bad.	Good.	Mod.	Bad.	Good.	Mod.	Bad.
1 to 15 years	Good	8	7	0	0	0	1	0	0	0	0	0	0	0
	Moderate	2	1	0	0	1	0	0	0	0	0	0	0	0
	Bad	1	1	0	0	0	0	0	0	0	0	0	0	0
	Total	11	9	0	0	1	1	0	0	0	0	0	0	0
15 to 45 years	Good	10	5	1	0	2	0	0	0	1	0	0	1	0
	Moderate	1	0	0	0	0	1	0	0	0	0	0	0	0
	Bad	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	11	5	1	0	2	1	0	0	1	0	0	1	0
45 to 60 years	Good	6	3	0	0	1	1	0	0	1	0	0	0	0
	Moderate	1	0	0	0	0	0	0	1	0	0	0	0	0
	Bad	1	0	0	1	0	0	0	0	0	0	0	0	0
	Total	8	3	0	1	1	1	0	1	1	0	0	0	0
Over 60 years	Good	5	3	0	0	1	1	0	0	0	0	0	0	0
	Moderate	1	0	0	0	0	1	0	0	0	0	0	0	0
	Bad	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	6	3	0	0	1	2	0	0	0	0	0	0	0
All ages	Good	29	18	1	0	4	3	0	0	2	0	0	1	0
	Moderate	5	1	0	0	1	2	0	1	0	0	0	0	0
	Bad	2	1	0	1	0	0	0	0	0	0	0	0	0
	Total	36	20	1	1	5	5	0	1	2	0	0	1	0

Average disability for all ages, 5.33 months.

TABLE XI.—OPERATIVE COMPARED WITH NON-OPERATIVE TREATMENT (HUMERUS)

	Total.	Period of disability.				
		Under 3 months.	Under 6 months.	Under 9 months.	Under 12 months.	Over 12 months.
1 to 15 years:						
Non-operative .	10 (90%)	9 (90%)	1 (10%)	0	0	0
Operative . .	1	0	1 (100%)	0	0	0
15 to 45 years:						
Non-operative .	8 (72%)	5 (62%)	2 (25%)	1 (12%)	0	0
Operative . .	3 (27%)	2 (66%)	0	0	0	0
45 to 60 years:						
Non-operative .	6 (75%)	3 (50%)	2 (33%)	1 (16%)	0	0
Operative . .	2 (25%)	1 (50%)	1 (50%)	0	0	0
Over 60 years:						
Non-operative .	3 (50%)	1 (33%)	2 (66%)	0	0	0
Operative . .	3 (50%)	2 (66%)	1 (33%)	0	0	0
All ages:						
Non-operative .	27 (75%)	18 (66%)	7 (25%)	2 (7%)	0	0
Operative . .	9 (25%)	5 (55%)	3 (33%)	0	1 (11%)	0

The series is too small to draw absolute conclusions. It appears from the above, however, that operative treatment lengthens the period of disability.

TABLE XII.—INFLUENCE ON RESULT OF TIME ELAPSING BETWEEN INJURY AND OPERATION (HUMERUS)

No. of cases.		Ages, years.		Date of operation, days.					Anatomical result.	Functional result.		
1 to 15	15 to 45	45 to 60	Over 60.	0 to 7	8 to 14	15 to 21	22 to 28	29		Good.	Mod.	Bad.
1	0	0	0	0	1	0	0	0	Good . . 1	0	1	0
									Moderate . 0	0	0	0
									Bad . . . 0	0	0	0
	3	0	0	1	0	1	0	1	Good . . 3	1	2	0
									Moderate . 0	0	0	0
									Bad . . . 0	0	0	0
		2	0	1	0	1	0	0	Good . . 2	2	0	0
									Moderate . 0	0	0	0
									Bad . . . 0	0	0	0
			3	1	1	1	0	0	Good . . 3	2	1	0
									Moderate . 0	0	0	0
									Bad . . . 0	0	0	0
	9	0	0	3	2	3	1	1	Good . . 9	5	4	0
									Moderate . 0	0	0	0
									Bad . . . 0	0	0	0
									9	5	4	0

Compound Fractures of the Humerus

TABLE I

	Total.	Non-operative.	Operative.
Humerus, shoulder	4	2	2
Humerus, shaft	15	4	11
Humerus, elbow	0	0	0
	19	6	13

TABLE II

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
Good	12 (63%)	11 (91%)	1 (8%)	0
Moderate	4 (21%)	1 (25%)	3 (75%)	0
Bad	3 (15%)	0	0	3 (100%)
	19 (99%)	12 (63%)	4 (21%)	3 (15%)

TABLE III.—NON-OPERATIVE

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
Good	6 (100%)	6 (100%)	0	0
Moderate	0	0	0	0
Bad	0	0	0	0
	6 (100%)	6 (100%)	0	0

TABLE IV.—OPERATIVE

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
Good	6 (46%)	5 (83%)	1 (16%)	0
Moderate	4 (30%)	1 (25%)	3 (75%)	0
Bad	3 (23%)	0	0	3 (100%)
	13 (99%)	6 (46%)	4 (30%)	3 (23%)

TABLE V.—INFLUENCE OF AGE ON THE FUNCTIONAL RESULT

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
1 to 15 years:				
Good	3 (75%)	3 (100%)	0	0
Moderate	0	0	0	0
Bad	1 (25%)	0	0	1 (100%)
	4 (100%)	3 (75%)	0	1(25%)

15 to 45 years:				
Good . . .	8 (57%)	6 (75%)	2 (25%)	0
Moderate .	4 (28%)	1 (25%)	3 (75%)	0
Bad . . .	2 (14%)	0	0	2 (100%)
	14 (99%)	7 (50%)	5 (35%)	2 (14%)
45 to 60 years:				
Good . .	1 (100%)	1 (100%)	0	0
Moderate .	0	0	0	0
Bad . . .	0	0	0	0
	1 (100%)	1 (100%)	0	0
All over 60 years, no cases.				
All over 15 years:				
Good . . .	9 (60%)	7 (77%)	2 (22%)	0
Moderate .	4 (25%)	1 (25%)	3 (75%)	0
Bad . . .	2 (13%)	0	0	2 (100%)
	15 (98%)	8 (53%)	5 (33%)	2 (13%)

TABLE VI.—INFLUENCE OF AGE ON THE FUNCTIONAL RESULTS (NON-OPERATIVE TREATMENT)

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
1 to 15 years:				
Good . . .	3 (100%)	3 (100%)	0	0
Moderate .	0	0	0	0
Bad . . .	0	0	0	0
	3 (100%)	3 (100%)	0	0
15 to 45 years:				
Good . .	1 (100%)	1 (100%)	0	0
Moderate .	0	0	0	0
Bad . . .	0	0	0	0
	1 (100%)	1 (100%)	0	0
45 to 60 years:				
Good . . .	2 (100%)	2 (100%)	0	0
Moderate .	0	0	0	0
Bad . . .	0	0	0	0
	2 (100%)	2 (100%)	0	0
All over 60 years, no cases.				
All over 15 years:				
Good . .	3 (100%)	3 (100%)	0	0
Moderate .	0	0	0	0
Bad . . .	0	0	0	0
	3 (100%)	3 (100%)	0	0

TABLE VII.—INFLUENCE OF AGE ON OPERATIVE TREATMENT

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
1 to 15 years:				
Good . . .	0	0	0	0
Moderate .	0	0	0	0
Bad . . .	1 (100%)	0	0	1 (100%)
	1 (100%)	0	0	1 (100%)
15 to 45 years:				
Good . .	7 (58%)	5 (71%)	2 (28%)	0
Moderate .	3 (25%)	1 (33%)	2 (66%)	0
Bad . . .	2 (16%)	0	0	2 (100%)
	12 (99%)	6 (50%)	4 (33%)	2 (16%)

45 to 60 years, no cases. Over 60 years, no cases.

TABLE VIII

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
		NON-OPERATIVE		
Shoulder:				
Good . .	2 (50%)	2 (100%)	0	0
Moderate .	0	0	0	0
Bad . . .	0	0	0	0
	2 (100%)	2 (100%)	0	0
		OPERATIVE		
Shoulder:				
Good . .	0	0	0	0
Moderate .	0	0	0	0
Bad . . .	2 (100%)	0	0	2
	2 (100%)	0	0	2 (100%)
		NON-OPERATIVE		
Shaft:				
Good . .	3 (100%)	3 (100%)	0	0
Moderate .	0	0 (100%)	0	0
Bad . . .	0	0	0	0
	3 (100%)	3 (100%)	0	0

		Operative		
Shaft:				
Good . . .	7 (58%)	5 (71%)	2 (28%)	0
Moderate .	4 (33%)	1 (25%)	3 (75%)	0
Bad . . .	1 (8%)	0	0	1 (100%)
	12 (99%)	6 (50%)	5 (41%)	1 (8%)

Elbow, non-operative, no cases.
Elbow, operative, no cases.

TABLE IX.—COMPARATIVE RESULTS OF OPERATIVE AND NON-OPERATIVE CASES OF COMPOUND FRACTURES OF THE HUMERUS

	Cases.	Operative cases.		Cases.	Non-operative cases.	
		Good anatomical result.	Good functional result.		Good anatomical result.	Good functional result.
Humerus, shoulder .	2	0	0	2	100%	100%
Humerus, shaft .	3	100%	100%	12	58%	71%
Humerus, elbow .	0	0	0	0	0	0

FRACTURES OF THE BONES OF THE FOREARM

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AND
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(By Invitation.)
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The non-operative treatment of fractures of the shafts of the radius and ulna gave 83 per cent. good functional, 77 per cent. good anatomical and 1 per cent. bad results. Operative methods gave 83 per cent. good functional results, 50 per cent. good anatomical results, 17 per cent. bad functional results. (Table VII.)

Non-operative treatment of fractures near joints gave 79 per cent. good functional and 77 per cent. good anatomical results. Operative treatment gave 72 per cent. good functional and 27 per cent. good anatomical results. (Table VIII.)

Disability was not longer than six weeks in 45 per cent. of the 257 cases and in 57 per cent. of the cases with good anatomical results. (Table X.)

The non-operative treatment of compound fractures gave 55 per cent. good functional results and the operative treatment gave 14 per cent. good functional results. The number of cases, 16, is too small for conclusions of value. (Table XI.)

In so far as conclusions are justified by a study and classification of the reported cases of fracture of the forearm bones it would seem that:

Non-operative treatment gave good functional results in 78 per cent. as compared to 68 per cent. operative, and showed only 2 per cent. bad functional results as compared to 13 per cent. bad functional results in the operative cases.

The cases operated on were in the main those in which injury was most extensive and delay in adequate treatment most pronounced. (Table III.)

Forearm fractures in the young (under fifteen years) gave the best results, both under conservative and operative treatment, if one small series (6 cases over sixty years of age) be excluded. (Tables IV, V, VI.)

Internal Fixation. Of the 43 cases with data only 36 are recorded with sufficient detail to be of service. Bone plates were used in 17 cases; catgut or tendon in 7; screws in 5; bone inlays in 4; and wire in 2. In 5 cases in the series the internal fixation had to be removed later (three bone inlays and two bone plates). In 3 of the 5 cases, 7.9 per cent. of the total number, infection seemed to be the cause.

Time of Operation. The earliest operation was within three hours; the latest was one hundred and twenty days. Only 4 cases were operated under forty-eight hours. Table XII shows that the best anatomical and functional results are obtained under early operation; that is, in the first and second weeks, each giving 50 per cent. good results. After the fourth week the results are over 50 per cent. bad for function.

TABLE I

	Total.	Non-operative.	Operative.
Radius, head	6	3	3
Radius, shaft	41	38	3
Radius, Colles's	100	95	5
Ulna, olecranon	15	12	3
Ulna, shaft	32	28	4
Radius and ulna, shafts	76	50	26
Total	270	226	44

Note.—In reading the following tables there will be found some discrepancies which, however, are due to incomplete history records and insufficient data. The percentage figures are always taken as the first whole number and no fractions considered.

TABLE II.—FRACTURES OF THE RADIUS AND ULNA

Anatomical result.		Functional result.							
		Total.		Good.		Moderate.		Bad.	
		Non-operative.	Operative.	Non-operative.	Operative.	Non-operative.	Operative.	Non-operative.	Operative.
Radius, Shaft	Good	33	2	33	2	0	0	0	0
	Moderate	5	0	2	0	3	0	0	0
	Bad	0	0	0	0	0	0	0	0
	Total	38	2	35	2	3	0	0	0
	Per cent.	100	100	90	100	70	0	0	0
Radius, Colles's	Good	70	2	65	2	5	0	0	0
	Moderate	13	2	4	1	7	1	2	0
	Bad	10	1	3	0	6	..	1	1
	Total	93	5	72	3	18	1	3	1
	Per cent.	100	100	77	60	0	20	60	20
Ulna, Shaft	Good	20	2	15	2	5	0	0	0
	Moderate	5	..	3	..	2	0	0	0
	Bad	3	2	2	..	1	1	0	1
	Total	28	4	20	2	8	1	0	1
	Per cent.	100	100	71	50	28	25	0	25
Radius and Ulna, Shafts	Good	26	12	24	10	2	2	0	0
	Moderate	13	8	6	2	7	6	0	0
	Bad	7	6	0	1	5	1	2	4
	Total	46	26	30	13	14	9	2	4
	Per cent	100	100	65	50	30	34	4	15
Radius, Head	Good	3	1	3	1	0	0	0	0
	Moderate	0	2	0	1	0	1	0	0
	Bad	0	0	0	0	0	0	0	0
	Total	3	3	3	2	0	1	0	0
	Per cent	100	100	100	66	0	33	0	0
Ulna, Olecranon	Good	10	0	10	0	0	0	0	0
	Moderate	1	3	0	3	1	0	0	0
	Bad	0	0	0	0	0	0	0	0
	Total	11	3	10	3	1	0	0	0
	Per cent	100	100	90	100	9	0	0	0
	Grand total	219	43	170	25	44	12	5	6
	Per cent.	100	100	78	68	20	27	2	13

TABLE III.—FRACTURES OF THE RADIUS AND ULNA.

Anatomical result.	Functional result.							
	Total.		Good.		Moderate.		Bad	
	Non-operative.	Operative.	Non-operative.	Operative.	Non-operative.	Operative.	Non-operative.	Operative.
Good . . .	162	19	150	17	12	2	0	0
Moderate . .	37	15	15	7	20	8	2	0
Bad . . .	20	9	5	1	12	2	3	6
Total . .	219	43	170	25	44	12	5	6
Per cent. . .	100	100	78	68	20	27	2	13

NOTE.—Only 4 cases were operated under forty-eight hours; 2 had good functional and anatomical results; 2 had bad functional and anatomical results.

TABLE IV.—INFLUENCE OF AGE ON THE FUNCTIONAL RESULT

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
Under 15 years:				
Good . . .	78	74	3	1
Moderate . .	18	13	5	0
Bad	8	3	4	1
Total . . .	104	90 (86%)	12 (11%)	2 (19%)
15 to 45 years:				
Good . . .	91	85	4	2
Moderate . .	12	3	8	1
Bad	11	2	4	5
Total . . .	114	90 (78%)	16 (14%)	8 (7%)
45 to 60 years:				
Good . . .	15	12	3	0
Moderate . .	8	5	3	0
Bad	7	1	3	3
Total . . .	30	18 (60%)	9 (30%)	3 (10%)
Over 60 years:				
Good . . .	7	6	1	0
Moderate . .	6	0	6	0
Bad	3	1	2	0
Total . . .	16	7 (43%)	9 (56%)	0
All over 15 years:				
Good . . .	113	103	9	2
Moderate . .	26	8	7	4
Bad	21	4	9	8
Total . . .	160	115 (72%)	25 (15%)	14 (8%)

TABLE V.—INFLUENCE OF AGE ON NON-OPERATIVE TREATMENT

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
Under 15 years:				
Good . . .	68	64	3	1
Moderate . .	16	13	3	0
Bad	4	2	1	1
Total . . .	88	79 (89%)	7 (7%)	2 (2%)
15 to 45 years:				
Good . . .	81	77	4	0
Moderate . .	7	1	5	1
Bad	7	2	4	1
Total . . .	95	80 (84%)	13 (13%)	2 (2%)
45 to 60 years:				
Good . . .	15	12	3	0
Moderate . .	8	5	3	0
Bad	5	1	3	1
Total . . .	28	18 (64%)	9 (62%)	1 (3%)
Over 60 years:				
Good . . .	6	6	0	0
Moderate . .	6	0	6	0
Bad	3	1	2	0
Total . . .	15	7 (46%)	8 (52%)	0
All over 15 years:				
Good . . .	102	95	8	0
Moderate . .	22	6	4	1
Bad	15	4	9	2
Total . . .	139	105 (75%)	21 (15%)	3 (2%)

TABLE VI.—INFLUENCE OF AGE ON OPERATIVE TREATMENT

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
Under 15 years:				
Good . . .	10	10	0	0
Moderate . .	2	0	2	0
Bad	4	1	2	0
Total . . .	16	11 (68%)	4 (25%)	0

15 to 45 years:				
Good	10	8	0	2
Moderate	5	2	3	0
Bad	4	0	0	4
Total	19	10 (52%)	3 (15%)	6 (31%)
45 to 60 years:				
Good	0	0	0	0
Moderate	0	0	0	0
Bad	2	0	0	2
Total	2	0	0	2 (100%)
Above 60 years:				
Good	1	0	1	0
Moderate	0	0	0	0
Bad	0	0	0	0
Total	1	0	1 (100%)	0
All over 15 years:				
Good	11	8	1	2
Moderate	5	2	3	0
Bad	6	0	0	6
Total	22	10 (45%)	4 (18%)	8 (37%)

TABLE VII.—FRACTURES OF SHAFTS OF THE LONG BONES

NON-OPERATIVE

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
Good	79	72	7	0
Moderate	23	11	12	0
Bad	10	2	6	2
Total	112	85 (83%)	25 (24%)	2 (1%)

This series does not contain Colles's, olecranon or radial head fractures.

OPERATIVE

Good	16	14	2	0
Moderate	8	2	6	0
Bad	8	1	2	5
Total	32	17 (53%)	10 (31%)	5 (17%)

TABLE VIII.—FRACTURES NEAR JOINTS

Non-operative

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
Good	83	78	5	0
Moderate	14	4	8	2
Bad	10	3	6	1
Total	107	85 (79%)	19 (17%)	3 (2%)

Operative

Good	3	3	0	0
Moderate	7	5	2	0
Bad	1	0	0	1
Total	11	8 (72%)	2 (18%)	1 (9%)

TABLE IX

Good Functional Results Following Non-operative Treatment

Site.	Total.	Good function.
Radius and ulna, shafts	112	85
Radius and ulna, extremities	107	85
Total	219	170 (78%)

Good Functional Results Following Operative Treatment

Radius and ulna, shafts	32	17
Radius and ulna, extremities	11	8
Total	43	25 (68%)

TABLE X.—PERIOD OF DISABILITY IN FRACTURES OF THE UPPER EXTREMITY

Anatomical result.	Total.	Under 6 weeks.	Under 12 weeks.	Under 24 weeks.	Over 24 weeks.
Good	174	100	55	12	7
Moderate	50	16	23	6	5
Bad	33	12	10	6	5
Total	257	128 (45%)	88 (33%)	24 (9%)	17 (8%)

NOTE.—This table shows that good anatomical results were associated with disability under six weeks in 45 per cent. of cases. Disability here had been taken to apply to time elapsing before return to work.

TABLE XI.—COMPOUND FRACTURE OF THE FOREARM GROUPED IN ONE SERIES BECAUSE OF SMALL NUMBER

Anatomical result.	Functional result.								
	Total.		Good.		Moderate.		Bad.		Died.
	Non-operative.	Operative.	Non-operative.	Operative.	Non-operative.	Operative.	Non-operative.	Operative.	
Good . . .	4	1	4	1	0	0	0	0	0
Moderate . .	2	3	0	0	2	3	0	0	0
Bad	3	3	1	0	0	1	3	1	2
Total . . .	9	7	5	1	2	4	3	1	2
Per cent . . .	0	0	53	14	22	57	33	14	0

Deaths: 1 from tetanus; 1 from shock and other injuries. Other deaths in the records were not attributable to the forearm condition.

TABLE XII.—TIME OF OPERATION ON FRACTURED FOREARM

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
1 to 7 days:				
Good . . .	7	6	1	0
Moderate . .	3	0	3	0
Bad	2	0	0	2
Total . . .	12 (100%)	6 (50%)	4 (33%)	2 (16%)
7 to 14 days:				
Good . . .	5	4	1	0
Moderate . .	2	0	2	0
Bad	1	0	0	1
Total . . .	8 (100%)	4 (50%)	3 (37%)	1 (12%)

14 to 21 days:				
Good	1	1	0	0
Moderate	3	0	3	0
Bad	1	0	0	1
Total	5 (100%)	1 (20%)	3 (60%)	1 (20%)
21 to 28 days:	No cases reported.			
Good				
Moderate				
Bad				
Total				
Over 28 days:				
Good	3	3	0	0
Moderate	1	0	1	0
Bad	5	0	0	5
Total	9 (100%)	3 (33%)	1 (11%)	5 (55%)

FRACTURES OF THE TIBIA AND FIBULA

By ASTLEY P. C. ASHHURST, M.D.
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The statistics presented herewith are based on the figures given in the report of this committee for the year 1915 with the addition of the cases since collected, making a total of 926 cases of fractures of the tibia and fibula which have been reported in sufficient detail to permit of study.

These cases are thus divided.

Simple fractures, 625 (non-operative, 555; operative, 70).

Compound fractures, 301 (non-operative, 184; operative, 117).

Total, 926 (non-operative, 739; operative, 187).

The thanks of the committee are extended to their collaborators, Dr. Otto C. Gaub, of Pittsburgh; Dr. Daniel F. Jones, of Boston; Dr. Kellogg Speed, of Chicago, as well as to Dr. Edward B. Hodge, of Philadelphia, for reports of cases; and especially to Dr. Irvine M. Boykin and Dr. Edward T. Crossan for collecting a very large number of end-results from the Episcopal Hospital of Philadelphia; also to Miss M. C. Lamor for tabulating the cases of fractures of the tibia and fibula.

The results are slightly better, in the more recently collected cases, than they were in those forming the subject of investigation in 1915; but in these latter, as well as in the earlier cases, these results are not ideal. They show that the treatment of fractures of the leg bones is still capable of much improvement.

The accompanying tables analyze separately all the simple fractures (Tables I to XIII inclusive) and subsequently (Tables XIV to XXI inclusive) the compound fractures.

Simple Fractures of the Leg Bones. These statistics (Tables I to XIII inclusive) relate only to recent, closed fractures.

Included in the analysis are the following 625 individual cases of fracture:

Simple Fractures of the Leg Bones, 1915 and 1921

TABLE I

	Total.	Non-operative.	Operative.
Fibula, shaft	46	46	
Tibia, shaft	114	92	22
Tibia and fibula, shafts	232	192	40
Tibia and fibula, ankle	109	101	8
Tibia, ankle	36	36	
Fibula, ankle	88	88	
	625	555	70

TABLE II

Anatomical result.	Total.	Good.	Functional result. Moderate.	Bad.
Good	476 (76%)	408 (86%)	60 (12%)	8 (2%)
Moderate	109 (18%)	57 (51%)	40 (39%)	12 (10%)
Bad	40 (6%)	3 (8%)	14 (35%)	23 (57%)
	625 (100%)	468 (75%)	114 (18%)	43 (7%)

TABLE III.—NON-OPERATIVE

Anatomical result.	Total.	Good.	Functional result. Moderate.	Bad.
Good	428 (77%)	372 (87%)	49 (11%)	7 (2%)
Moderate	94 (17%)	49 (52%)	36 (38%)	9 (10%)
Bad	33 (6%)	1 (3%)	12 (36%)	20 (61%)
	555 (100%)	422 (76%)	97 (17%)	36 (7%)

TABLE IV.—OPERATIVE

Anatomical result.	Total.	Good.	Functional result. Moderate.	Bad.
Good	48 (69%)	36 (75%)	11 (23%)	1 (2%)
Moderate	15 (21%)	8 (53%)	4 (27%)	3 (20%)
Bad	7 (10%)	2 (28%)	2 (28%)	3 (44%)
	70 (100%)	46 (66%)	17 (24%)	7 (10%)

As in our previous report a much larger number of case records was examined, but many had to be rejected partly or entirely because of lack of data. This insufficiency in regard to certain details accounts for the fewer number of cases analyzed in some tables than in others.

We have tried to maintain the standard as set forth under the heading of *Definitions* on page 12 of our 1915 report. But in many of the reports received the examining surgeons appear to

TABLE V.—INFLUENCE OF AGE ON THE FUNCTIONAL RESULT

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
Under 15 years:				
Good . .	51 (88%)	49 (96%)	1 (2%)	1 (2%)
Moderate .	6 (10%)	3 (50%)	3 (50%)	
Bad . . .	1 (2%)	...	1 (100%)	
	58 (100%)	52 (89%)	5 (9%)	1 (2%)
15 to 45 years:				
Good . .	244 (80%)	217 (89%)	25 (10%)	2 (1%)
Moderate .	48 (16%)	28 (58%)	18 (38%)	2 (4%)
Bad . . .	11 (4%)	2 (18%)	6 (55%)	3 (27%)
	303 (100%)	247 (82%)	49 (16%)	7 (2%)
45 to 60 years:				
Good . .	70 (67%)	56 (80%)	11 (16%)	3 (4%)
Moderate .	23 (22%)	11 (48%)	8 (35%)	4 (17%)
Bad . . .	12 (11%)	...	5 (42%)	7 (58%)
	105 (100%)	67 (64%)	24 (23%)	14 (13%)
Over 60 years:				
Good . .	17 (77%)	12 (71%)	4 (23%)	1 (6%)
Moderate .	3 (14%)	1 (33.3%)	1 (33.3%)	1 (33.4%)
Bad . . .	2 (9%)	...	....	2 (100%)
	22 (100%)	13 (59%)	5 (23%)	4 (18%)
All over 15 years:				
Good . .	331 (77%)	285 (86%)	40 (12%)	6 (2%)
Moderate .	74 (17%)	40 (55%)	27 (36%)	7 (9%)
Bad . . .	25 (6%)	2 (8%)	11 (44%)	12 (48%)
	430 (100%)	327 (76%)	78 (18%)	25 (6%)

have been less strict than the committee, and therefore the statistical tables probably show better results than actually are obtained in practice. For instance, some reports received have classed as "good" anatomical results cases in which shortening of as much as 3 cm. was recorded; and as "good" functional results cases in which pain in damp weather persisted or where there was evident, but not disabling, limitation of motion and

TABLE VI.—INFLUENCE OF AGE ON NON-OPERATIVE TREATMENT

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
Under 15 years:				
Good . .	47 (90%)	46 (98%)	1 (2%)	
Moderate .	4 (8%)	2 (50%)	2 (50%)	
Bad . . .	1 (2%)	...	1 (100%)	
	52 (100%)	48 (92%)	4 (8%)	
15 to 45 years:				
Good . .	218 (81%)	199 (91%)	17 (8%)	2 (1%)
Moderate .	41 (16%)	23 (57%)	17 (41%)	1 (2%)
Bad . . .	9 (3%)	1 (11%)	5 (56%)	3 (33%)
	268 (100%)	223 (83%)	39 (15%)	6 (2%)
45 to 60 years:				
Good . .	66 (70%)	54 (81%)	9 (14%)	3 (5%)
Moderate .	20 (21%)	9 (45%)	8 (40%)	3 (15%)
Bad . . .	9 (9%)	...	5 (56%)	4 (44%)
	95 (100%)	63 (66%)	22 (23%)	10 (11%)
Over 60 years:				
Good . .	17 (77%)	12 (70%)	4 (24%)	1 (6%)
Moderate .	3 (14%)	1 (33.3%)	1 (33.3%)	1 (33.4%)
Bad . . .	2 (9%)	...	....	2 (100%)
	22 (100%)	13 (59%)	5 (23%)	4 (18%)
All over 15 years:				
Good . .	301 (78%)	267 (88%)	30 (10%)	6 (2%)
Moderate .	64 (17%)	33 (50%)	27 (42%)	5 (8%)
Bad . . .	20 (5%)	1 (5%)	10 (50%)	9 (45%)
	385 (100%)	299 (78%)	66 (17%)	20 (5%)

where disability was "partial," not entirely "absent." Our definitions showed that such results should have been classed as "moderate" or "bad" in anatomy and function according to the degree of deformity and disability; and though an effort was made to correct very glaring inaccuracies of this kind in the reports received, it is probable a number have been passed undetected.

Table II shows the functional result in all the cases reported; and it certainly is not creditable that only 75 per cent of the whole number of patients recovered good function. Table III

TABLE VII.—INFLUENCE OF AGE ON OPERATIVE TREATMENT

Anatomical result.	Total.	Good.	Functional result. Moderate.	Bad.
Under 15 years:				
Good . .	4 (67%)	3 (75%)	....	1 (25%)
Moderate .	2 (33%)	1 (100%)	1 (100%)	
Bad . . .				
	6 (100%)	4 (66%)	1 (17%)	1 (17%)
15 to 45 years:				
Good . .	26 (74%)	18 (69%)	8 (31%)	
Moderate .	7 (20%)	5 (72%)	1 (14%)	1 (14%)
Bad . . .	2 (6%)	1 (50%)	1 (50%)	
	35 (100%)	24 (68%)	10 (29%)	1 (3%)
45 to 60 years:				
Good . .	4 (40%)	2 (50%)	2 (50%)	
Moderate .	3 (30%)	2 (67%)	....	1 (33%)
Bad . . .	3 (30%)	...	....	3 (100%)
	10 (100%)	4 (40%)	2 (20%)	4 (40%)
Over 60 years:				
Good	....	....	....	....
Moderate	....	....	....	....
Bad . . .	....	....	....	....
All over 15 years:				
Good . .	30 (67%)	20 (67%)	10 (33%)	
Moderate .	10 (22%)	7 (70%)	1 (10%)	2 (20%)
Bad . . .	5 (11%)	1 (20%)	1 (20%)	3 (60%)
	45 (100%)	27 (62%)	12 (27%)	5 (11%)

and Table IV show the functional results in non-operative and operative cases respectively. It is especially worthy of note that in each case the greatest number of patients who secure good function are those in whom the anatomical result is good (87

TABLE VIII.—FRACTURES OF THE TIBIA AND THE FIBULA

Anatomical results.	Functional results.							
	Total.		Good.		Moderate.		Bad.	
	Non-operative.	Operative.	Non-operative.	Operative.	Non-operative.	Operative.	Non-operative.	Operative.
	SHAFTS (also Shaft of the Tibia alone)							
Good	206 (70%)	41 (67%)	181 (88%)	33 (81%)	21 (10%)	6 (14%)	4 (2%)	2 (5%)
Moderate	69 (23%)	15 (24%)	41 (59%)	8 (54%)	23 (33%)	4 (26%)	5 (8%)	3 (20%)
Bad	22 (79%)	6 (9%)	1 (5%)	1 (17%)	11 (50%)	2 (33%)	10 (45%)	3 (50%)
Total	297	62	223	42	55	12	19	8
Per cent	(100%)	(100%)	(75%)	(68%)	(19%)	(19%)	(6%)	(13%)
	ANKLE (All Forms)							
Good	185 (82%)	8 (100%)	156 (84%)	3 (38%)	26 (14%)	5 (62%)	3 (2%)	
Modcrate	26 (12%)	...	8 (31%)	...	14 (54%)	...	4 (15%)	
Bad	13 (6%)	...	... ...	... ...	1 (8%)	...	12) (92%	
Total	224	8	164	3	41	5	19	
Per cent	(100%)	(100%)	(73%)	(38%)	(18%)	(62%)	(9%)	

TABLE IX.—AVERAGE PERIOD OF DISABILITY

Site of fracture.	All cases.	Average period of disability (months).	Cases terminated under 12 (months).	Average period of disability (months)
Tibia or tibia and fibula, shafts	331	4.7	316	4.2
Ankle	225	4.0	218	3.5
	556*		534	

* 35 extra cases not included in Table VIII are included in Table IX.

per cent in non-operative cases, 75 per cent in operative cases); and conversely, that the worse the anatomical result the worse is function sure to be. Hence it is cause for regret that in the entire series a good anatomical result was secured only in 76

TABLE X.—DOES GOOD ANATOMICAL RESULT LESSEN THE PERIOD OF DISABILITY? FRACTURES OF THE LEG BONES (ALL FORMS)

Anatomical result.	Total.	Under 3 months.	Under 6 months.	Under 9 months.	Under 1 year.	Over 1 year.
Good . .	335 (79%)	177 (53%)	118 (35%)	30 (9%)	6 (2%)	4 (1%)
Moderate .	69 (16%)	15 (22%)	33 (47%)	15 (22%)	2 (3%)	4 (6%)
Bad . . .	20 (5%)	3 (15%)	9 (45%)	3 (15%)	1 (5%)	4 (20%)
	424 (100%)	195 (46%)	160 (38%)	48 (11%)	9 (2%)	12 (3%)

TABLE XI.—GOOD FUNCTIONAL RESULTS FOLLOWING OPERATIVE AND NON-OPERATIVE TREATMENT (SIMPLE FRACTURES)

Site.	American Surgical Association, 1921.		British Medical Association, 1912.	
	Total.	Good function.	Total.	Good function.
Tibia and fibula, shafts . .	338	239 (70%)	1014	779 (76%)
Ankle fractures	232	188 (81%)	259	127 (49%)
Total leg fractures . . .	570	437 (76%)	1273	906 (71%)

TABLE XII.—GOOD FUNCTIONAL RESULTS FOLLOWING NON-OPERATIVE TREATMENT (SIMPLE FRACTURES)

Site.	American Surgical Association, 1921.		British Medical Association, 1912.	
	Total.	Good function.	Total.	Good function.
Tibia and fibula, shafts . .	297	206 (70%)	975	748 (76%)
Ankle fractures	224	185 (82%)	255	125 (49%)
Total leg fractures . . .	521	391 (75%)	1230	873 (71%)

TABLE XIII.—GOOD FUNCTIONAL RESULTS FOLLOWING OPERATIVE TREATMENT (SIMPLE FRACTURES)

Site.	American Surgical Association, 1921.		British Medical Association, 1912.	
	Total.	Good function.	Total.	Good function.
Tibia and fibula, shafts	41	33 (82%)	39	31 (79%)
Ankle fractures	8	3 (37%)	4	2 (50%)
Total leg fractures	49	36 (73%)	43	33 (76%)

TABLE XIV.—COMPOUND FRACTURES

	Total.	Non-operative.	Operative.
Fibula, shaft	13	9	4
Tibia, shaft	73	43	30
Tibia and fibula, shafts	206	125	81
Tibia and fibula, ankle	6	5	1
Tibia, ankle	2	1	1
Fibula, ankle	1	1	
	301	184	117

TABLE XV.—COMPOUND FRACTURES

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
Good	167 (58%)	156 (93%)	8 (5%)	3 (2%)
Moderate	83 (29%)	21 (25%)	54 (65%)	8 (10%)
Bad	39 (13%)	3 (8%)	7 (18%)	29 (74%)
	289 (100%)	180 (62%)	69 (24%)	40 (14%)

TABLE XVI.—NON-OPERATIVE CASES (COMPOUND FRACTURES)

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
Good	109 (61%)	102 (93%)	6 (6%)	1 (1%)
Moderate	51 (29%)	15 (29%)	33 (65%)	3 (6%)
Bad	18 (10%)	1 (6%)	3 (17%)	14 (77%)
	178 (100%)	118 (67%)	42 (23%)	18 (10%)

per cent of cases (77 per cent of non-operative and only 69 per cent of operative cases). Should not surgeons be able to secure accurate anatomical reposition of the fragments ("good anatomy") in more than two-thirds of the cases they subject to open reduction?

The influence of age on the functional result is shown in Tables V, VI and VII. These figures emphasize the fact so clearly demonstrated in our earlier tables that in patients under fifteen years of age good function is obtainable with most certainty, and that the older the patient the less certain is good function to be secured. They indicate, moreover, that in patients under fifteen years of age good function is secured in 92 per cent of cases without resort to operation.

In regard to *operative treatment of simple fractures of the leg bones* these tables appear to show that it has proved less easy

TABLE XVII.—OPERATIVE CASES (COMPOUND FRACTURES)

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
Good . . .	58 (52%)	54 (94%)	2 (3%)	2 (3%)
Moderate . .	32 (29%)	6 (19%)	21 (65%)	5 (16%)
Bad . . .	21 (19%)	2 (10%)	4 (19%)	15 (71%)
	111 (100%)	62 (56%)	27 (24%)	22 (20%)

TABLE XVIII.—INFLUENCE OF AGE ON THE FUNCTIONAL RESULT (COMPOUND FRACTURES)

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
Under 15 years:				
Good . .	17 (55%)	15 (88%)	1 (6%)	1 (6%)
Moderate .	9 (29%)	2 (22%)	7 (78%)	
Bad . . .	5 (16%)	1 (20%)	....	4 (80%)
	31 (100%)	18 (58%)	8 (26%)	5 (16%)
Over 15 years:				
Good . .	150 (58%)	141 (94%)	7 (5%)	2 (1%)
Moderate .	74 (29%)	19 (26%)	47 (63%)	8 (11%)
Bad . . .	34 (13%)	2 (6%)	7 (21%)	25 (73%)
	258 (100%)	162 (62%)	61 (24%)	35 (14%)

to secure anatomical reposition of the fragments by operation at any age period (40 to 74 per cent of good anatomical results) than when no operation is done (70 to 90 per cent of good anatomical results); but it must not be overlooked that in the cases treated without operation are included all the subperiosteal and incomplete fractures as well as all those with only trifling displacement in which no reduction of the fragments is required; while in the operative series, almost only, are those fractures with great displacement (overriding, angulation, rotation) in which reduction by non-operative means has usually been tried and has failed before operation was undertaken.

TABLE XIX.—COMPOUND FRACTURES OF THE TIBIA AND THE FIBULA

Anatomical results.	Functional results.							
	Total.		Good.		Moderate.		Bad.	
	Non-operative.	Operative.	Non-operative.	Operative.	Non-operative.	Operative.	Non-operative.	Operative.
SHAFTS (also Shaft of the Tibia alone)								
Good	105 (63%)	58 (53%)	99 (94%)	54 (94%)	6 (6%)	2 (3%)	... ...	2 (3%)
Moderate	46 (27%)	30 (28%)	15 (33%)	6 (20%)	29 (63%)	19 (63%)	2 (4%)	5 (17%)
Bad	17 (10%)	21 (19%)	1 (6%)	2 (10%)	3 (18%)	4 (19%)	13 (76%)	15 (71%)
Total	168	109	115	62	38	25	15	22
Per cent	(100%)	(100%)	(69%)	(57%)	(22%)	(23%)	(9%)	(20%)
ANKLE (All Forms)								
Good	2 (29%)	... ...	1 (50%)	... ...	... ...	... ...	1 (50%)	
Moderate	4 (57%)	2 (100%)	... ...	... ...	3 (75%)	2 (100%)	1 (25%)	
Bad	1 (4%)	... ...	... ...	... ...	... ...	... ...	1 (100%)	
Total	7	2	1	...	3	2	3	
Per cent	(100%)	(100%)	(14%)	...	(43%)	(100%)	(43%)	

One death is recorded from sepsis, five and a half months after open operation and fixation of the tibia by a steel plate.

In Table VIII the anatomical and functional results are analyzed according as the fractures involved the shafts of the leg bones or affected the ankle. Our 1915 statistics clearly showed how much more serious was the prognosis in joint fractures. And in the present table we note that whereas in the case of the shafts of the leg bones bad function follows bad anatomy only in 45 per cent of cases (non-operative), yet in the case of ankle fractures bad anatomical results ensure bad function in 92 per cent of cases. In the shafts of the leg bones a moderate anatomical result secures good function in 58 per cent of cases, whereas in the case of ankle fractures a moderate anatomical result secures good function in less than a third of the cases (31 per cent).

The *average period of disability* in our combined figures (1915 and 1921) shows a slight improvement; in 1915 we found the average period of disability for both shaft and ankle fractures was nearly five months (four and nine-tenths); in the combined statistics, based on 556 cases, this is reduced to four and seven-

TABLE XX.—AVERAGE PERIOD OF DISABILITY (COMPOUND FRACTURES)

Site of fracture.	All cases.	Average period of disability (months).	Cases terminated under 12 (months).	Average period of disability (months).
Tibia or tibia and fibula, shafts	82	7.0	66	5.4
Ankle	8	5.7	8	5.7
	90		74	

TABLE XXI.—DOES GOOD ANATOMICAL RESULT LESSEN THE PERIOD OF DISABILITY? COMPOUND FRACTURES OF THE LEG BONES (ALL FORMS)

Anatomical result.	Total.	Under 3 months.	Under 6 months.	Under 9 months.	Under 1 year.	Over 1 year.
Good . . .	39 (43%)	8 (20%)	21 (54%)	5 (13%)	1 (3%)	4 (10%)
Moderate .	37 (41%)	3 (8%)	15 (39%)	11 (30%)	1 (4%)	7 (19%)
Bad . . .	14 (16%)	....	5 (36%)	2 (14%)	2 (14%)	5 (36%)
	90 (100%)	11 (13%)	41 (45%)	18 (20%)	4 (4%)	16 (18%)

tenths months for fractures of the shafts of the leg bones and to four months only in the case of ankle fractures. Or if only those cases are included in which the period of disability was less than twelve months the figures show an average of four and one-fifth months for the shaft fractures and only three and a half months for the ankle fractures. These later investigations confirm our former conclusions that patients with fractures of the lower extremity whose period of disability exceeds twelve months usually are permanently crippled.

Table X indicates very positively that a good anatomical result lessens the period of disability: 88 per cent of patients with good anatomical results have a period of diability of less than six months; whereas only 69 per cent of those with a moderate anatomical result are able to resume their usual occupations within that space of time.

Comparative Results Shown in American and British Statistics. In Tables XI, XII and XIII are analyzed in parallel columns the results now recorded by the Fracture Committee of the American Surgical Association and those published in 1912 by the Fracture Commission of the British Medical Association. It will be seen that though the latter figures are based on more than twice as many case reports as the American figures, yet that the gross results are sensibly the same, with a small margin to the credit of the American statistics (76 per cent good results compared to 71 per cent good results of the British cases). While the total number of cases of operative treatment is rather too small to make the results very significant (especially in the case of ankle fractures) the great difference in the proportion of good results secured in the non-operative treatment of ankle fractures certainly is worthy of comment. The British statistics show that only 49 per cent of their patients with ankle fractures secured good function, while 82 per cent of American patients recovered without disability; and these figures are the more noteworthy because the number of end-results recorded is very nearly the same in each case (255 British and 224 American). It is possible

that our methods of treatment are more efficient now than those employed by the British a decade ago, and that the interest in fractures aroused in this country by the previous report of this committee is beginning to tell on the end-results; but it seems more likely that in this country more accurate diagnosis has been secured through the more general use of the roentgen ray during the past nine years, and that on this account the American figures include more cases of fracture without displacement than do the British statistics.

Compound Fractures of the Leg Bones. Our tables include 301 cases: 184 non-operative and 117 operative. Good anatomical results were secured only in 58 per cent of cases and good function only in 62 per cent; but of the 167 patients in whom anatomical reposition of the fragments was secured (or in whom no displacement existed) no less than 93 per cent recovered without disability. And, as in the case of simple fractures of the leg bones, it is worthy of comment that even with operative treatment only half the cases (58 out of 111 patients) secured good anatomical results and only a little more than half (56 per cent) secured good function; but that in 54 out of 58 patients, or in 94 per cent of those in whom the surgeon succeeded in obtaining anatomical reposition of the fragments, recovery without any disability is recorded. And the importance of securing accurate anatomical reposition of the fragments is even more apparent in the cases of compound fractures than was the case in simple fractures. In the latter even a moderate anatomical result will allow good function to result in more than half the cases; but in compound fractures only one-quarter of the patients will secure good function unless accurate reduction is secured.

The average period of disability for patients with compound fractures of the shafts of the leg bones is seven months and for those of the ankle five and seven-tenths months. If good anatomical results are obtained, 74 per cent of patients can return to work in less than six months, compared with not more than 47 per cent of patients if only moderate anatomical results are secured.

Conclusions. These investigations emphasize anew the importance of securing anatomical reposition of the fragments not only to secure ultimate good function, but even more to lessen the period of disability. The means of securing reduction naturally vary; in comparatively few cases can gross displacements of the leg bones be corrected by manipulation alone, even with the patient under the influence of a general anesthetic; and such manipulations may do more damage to the soft parts than open operation with direct exposure of the fracture. This objection applies even to reduction by mechanical traction if the latter is employed for rapid reduction. On the other hand *continuous traction* (without the use of an anesthetic except for the primary application of the apparatus) prolonged over a period of several days frequently will secure reduction of overriding and angulation in cases in which attempts at rapid reduction end in failure. Such continuous traction is to be continued after reduction has been secured until the process of union is so far advanced as to prevent recurrence of deformity. This period varies from ten days to three weeks. For such gradual reduction the reporter believes that for fractures of the leg *skeletal traction* by means of the Codivilla or the Steinmann nail is more readily applied and more efficient in the hands of the operating surgeon than is traction secured by means of a Sinclair skate or other indirect apparatus. Skeletal traction is especially indicated in cases of comminuted fractures, simple or compound, in which open fixation of so many fragments would prove difficult or dangerous. In irreducible fractures (whether simple or compound), with two or three fragments only, fixation by a steel plate after open reduction is preferred; but for fractures whose obliquity exceeds twice the diameter of the bone, fixation by encircling bands or wires is more efficient.

Ankle fractures, even more imperatively than fractures of the shafts of the leg bones, require accurate anatomical reduction. The value of the flexed position of the limb in permitting reduction of the fragments (originally advocated by Pott) is not sufficiently appreciated at the present day; nor is the aid to

be derived from tenotomy of the tendon of Achilles. In cases in which one or two well-directed attempts under anesthesia fail to secure reduction of the fracture, open reduction should be done, and in most cases direct fixation of the exposed fragments is requisite.

Finally, the investigations of this committee merely point the way for further improvements in our means of treating fractures of the leg bones. No surgeon having such fractures under his care should rest satisfied until he can publish a series of end-results which in the aggregate will be superior to those recorded in this report, for these are merely the *average*.

FRACTURES OF THE FEMUR

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On account of irregularity in the notes and the absence of much important data a large number of the cases sent in for this report could not be used. Other report sheets were not full; it has required much time and labor to cull from them some of the information the committee set out to ascertain.

There were 584 cases of simple and 70 cases of compound fractures of the femur reported; they were followed up and the final results were ascertained. These cases are used and analyzed and form the basis of the tables. The effort has been made to have the tables full enough and so diversified that the figures themselves will tell the various points one would like to know, especially in regard to the average result of the treatment of fractures of the femur during the last five years.

Unfortunately one of the essential points, namely, method of treatment, has rarely been noted with sufficient accuracy to be made of any great use, except that it is always noted whether a case was treated by the non-operative or closed method or by the operative or open method.

The cases were divided as follows:

Fractures of the neck of the femur	100
Fractures through the trochanters	19
Fractures of the shaft	457
Fractures of the condyles	8
Total	584

There were 448 cases treated by the non-operative method and 136 by the operative method (23.28 per cent of the cases).

Indirect violence in civil life causes 80.6 per cent of all fractures of the femur.

The region involved most frequently in the age period:

One to fifteen years is the middle third.

Fifteen to forty-five years is also the middle third.

Forty-five to sixty years is the neck.

Sixty years and over is also the neck.

Transverse fractures are much more frequent than oblique or other forms of fractures. Spiral and longitudinal fractures of the femur are rare.

The average shortening before reduction was attempted in fractures of the shaft of the femur is 3.5 cm. The average shortening after reduction is 1.5 cm. Shortening after a fracture of the shaft of the femur as much as 2 cm. means the fragments are not apposed end to end; there must be some overlapping. It should be remembered, however, that uninjured femora are frequently of unequal lengths; they not unusually vary as much as 1 cm. Shortening determined by the ordinary methods of measuring extremities is misleading and unreliable. Properly taken skiagrams are much more reliable indices of good anatomical results than shortening. The two methods should both be used to determine the condition. Many cases have demonstrated that as much as 2 cm. shortening by measurements does not prevent good functional results. On the other hand it has been shown that by traction methods the injured extremity may be extended even beyond the measured length of the uninjured member, and yet the fluoroscope will show inaccurate alignment of the fragments. Union in such a position could never rightly be called a good anatomical result. In a series of over 200 cases in which measurements showed no or very little shortening, roentgen-ray examination showed only 2 per cent of accurate anatomical results.

Treatment. It is interesting to note that since the war American surgeons have practically discarded the old Buck's

traction method and are using for the purpose of extension some form of suspension with traction.

A Balkan frame or some modification of this apparatus is the popular one now. Also traction directly on the distal fragment by means of the Steinmann nail, or by some form of tongs, is much more frequently employed than formerly.

The apparatus which proved invaluable in the military service, and which stands out now as the most useful of splints for treating fractures of the femur and humerus, is the Thomas splint. Easily adapted to varying conditions, and efficient in the majority of cases, the Thomas splint is the apparatus which the general practitioner and the surgeon who must treat a fractured shaft of the femur outside a hospital may use with efficiency, and if properly handled, with confident expectation of a good functional result.

Some very late data, obtained from one of the leading hospitals in the United States, are available fortunately for comparison in regard to the improved results of treatment of fractures of the femur. The series of cases is only 57, but is sufficient to bring out some salient points. There were 16 fractures of the neck and 41 fractures of the shaft. The Thomas splint was used in 24 of the cases of fracture of the shaft, sometimes with and sometimes without a Balkan frame. The Balkan frame with suspension-traction was used in 6 cases, and the other 11 cases were variously treated. No Buck extension, however, was used. For comparison the following figures showing the result of the older and newer methods will be interesting and instructive.

In the much larger series of cases treated by the older methods the results were as follows:

NON-OPERATIVE CASES

	Recovered under 6 months.	Recovered over 6 months.
1 to 15 years	83 per cent	17 per cent
15 to 45 "	46 "	54 "
45 to 60 "	53 "	47 "
Over 60 "	14 "	86 "

New Treatment

	Recovered under 6 months.	Recovered over 6 months.
1 to 15 years	100.0 per cent	
15 to 45 "	28.5 "	71.5 per cent
Over 60 " (no cases).		

It is evident that the result in childhood has been a quicker recovery by the methods of suspension and traction. This may be explained perhaps by the difference in rating "ability to work." In this day of compensation laws the period of disability for adult cases may be reckoned a little longer than formerly. Taken, however, solely as a matter of statistics the newer methods do not produce earlier recovery in the class of men whose usefulness counts most in industrial life. These ratings, be it understood, are for the periods of disability, and in this report period of disability is taken to mean the time from the instant of injury to that of the returning to work.

No surgeon reporting fractures of the femur has noted the use of some efficient form of caliper after union of the fragments when the patient begins to walk about.

Calipers should be used for some weeks in order to prevent bending or other distortion at the seat of fracture as soon as the vertical position and weight-bearing is permitted.

Results of Fracture of the Femur. These results are rated as anatomical and functional, and good, moderate and bad.

A good anatomical result is taken to mean firm bony union of the well-apposed fragments in the proper axis of the limb.

A good functional result is taken to mean no persistent stiffness of joints or resulting skeletal deformity, and unimpaired ability to do active work or exercise without pain or discomfort.

Table III shows the results of 447 non-operative cases. It will be observed that out of this number there were 180 (42 per cent) good anatomical results, but of these 180 good anatomical results only 157 (87 per cent) proved good functional results: 18 (10 per cent) were moderate and 5 (3 per cent) were positively bad results. Omitting the analysis of the moderate anatomical

results, and going directly to the bad, it will be seen that out of 65 positively bad anatomical results there followed 14 good and 15 moderate functional results, or 44.6 per cent of these bad anatomical results were followed by useful function. The operative cases in Table IV show this point also, but to a less degree.

The results of a fractured femur may be rated in two ways:

1. Scientifically.
2. Industrially.

1. Scientific rating takes in (*a*) the restoration of anatomical integrity and (*b*) restoration of full function of the part.

2. Industrial rating concerns itself solely with restoration of good function.

That these two ratings must necessarily be the same is conclusively disproved by practically all the tables. Reference to Tables III and IV, however, will show the point conclusively.

It is shown by Table III that of 447 cases of fracture of the femur treated by non-operative methods, 180, or 40 per cent, had good anatomical results; 180, or 40 per cent, had moderate anatomical results, and of these 360 cases, 254, or 70.5 per cent, were restored to usefulness, viz.: 157 had good functional results; 58, or 13 per cent, had bad functional results, and 22, or 4.9 per cent, died.

This means that surgeons of the United States and Canada by average non-operative treatment obtain good functional results in 62 per cent of their cases of fracture of the femur in all regions and in all age periods; 23 per cent have moderate functional results—these may be considered as not fully restored but able to do some useful work. The death-rate of this series is a little too high to be representative. This is explained by the fact that these records were culled from over 1000 records altogether and used because the data were full enough to give most of the desired information on the blanks. To check this death-rate another series of over 700 cases was analyzed and the death-rate was found to be 3.69 per cent. This is too low evidently. The true death-rate is probably the mean of these two series

of cases, viz.: about 4 per cent. All these deaths occurred in aged people.

To ascertain the region which when fractured is followed by most deaths an analysis of 131 cases was made as follows:

	Cases.	Deaths.
Fractures of the neck of the femur	31	12
Fractures through the trochanters	7	7
Fractures of the upper one-third of shaft	18	2
Fractures of the middle one-third of shaft	61	2
Fractures of the lower one-third of shaft	14	0
Total	131	23

One must conclude, therefore, that fractures of the upper segments of the femur with the usual concomitant injuries are for aged people very serious injuries indeed.

The causes of death were stated as follows:

	Cases.
Decubitus and sepsis	3
Gangrene and sepsis	1
Shock and exhaustion	16
Pneumonia	2
Pulmonary embolism	1

Operative Treatment. There were 137 operative cases out of a total of 584 cases; 23.28 per cent of the cases of fractures of all regions of the femur were treated by the operative method. Only 15 of the operative cases were fractures involving the extremities of the bone.

There were 7 operations for fractures of the neck.

There were 4 operations for fractures through the trochanters.

There were 4 operations for fractures of the condyles.

There were 121 operations for fractures of the shaft.

Analysis of the cases shows exactly twice as many operations were done for fractures of the middle third of the shaft as for both the upper and lower third together.

Fixation of the bone fragments by some manner of rigid plate was usually the method employed in these cases. Only one death is reported in the series of 136 operative cases; this fatal result was on account of sepsis.

Table IV gives the results in the operative cases. It is shown that though the anatomical results are rated good in 68 per cent of the cases as against 40 per cent in the non-operative method, good functional result is only 77 per cent as compared with 87 per cent of the non-operative cases. Further analysis given in the later tables shows comparatively few cases in the age period one to fifteen years were treated by the operative method; the operative cases were chiefly adult cases. Besides, these cases were operated, in nearly every instance, only because non-operative methods were unsuccessful in obtaining reduction. They were difficult and sometimes complicated cases. It could not reasonably be expected, therefore, that the ultimate result functionally should be as good as the uncomplicated non-operative cases. The interesting point is, however, that of the 94 cases which has good anatomical results, only 73, or 77 per cent, of them obtained good functional results. The moderate functional result ratio is a little higher than the non-operative methods, namely, 23 per cent against 10 per cent. These figures mean that though better anatomical results may be obtained by operative methods, functional results are not as good.

Table XIV shows the average period of disability after operative methods also is a little longer.

Only one death is recorded in this series of 137 operative cases; this occurred from infection. In another series of 146 cases, 2 deaths were reported. Even this is too low as indicative of the results obtained by the average surgeon. The true death-rate following operative treatment of fracture of the femur is about 6 per cent.

One must bear in mind that very few children and no senile cases were operated upon. Individuals in adult life, and presumably in good physical condition, were those treated by the operative method. Good operative recoveries in such cases are to be expected. One marvels, however, that only 1 case of infection was reported in this series of 137 cases.

It is noteworthy that in non-operative cases the functional

results from the moderate anatomical results is much better than in operative cases. In order to obtain good results in operative cases it is very important that good anatomical restitution be obtained. It is shown in Table XV that operative cases have better results when the operation is done soon after the fracture.

The series of 125 cases analyzed seem, however, to show that when the operation is done not later than eight to fourteen days after the injury the results are as good as when the operation is done the first week. *The period of disability is, however, longer after the later operations.*

Period of Disability. The period of disability should be worked out separately for the age period one to fifteen years and for the years of adult life.

In the first place, for purposes of reference and for industrial insurance companies, including compensation boards, the average time of disability for individuals in the working periods of their lives is the one desired to be established. In the second place the time of disability for children cannot be reckoned in the same manner as that for adults. As was stated before, the time of disability in this report is taken to mean the period from the instant of injury to the time the injured person is actually able to return to his former occupation or to some business requiring equal activity and endurance.

Children, as a rule, have no occupation and they are able to go about on their feet and appear restored to full activity at a much earlier period than adults. Therefore, separate classification is made in reckoning periods of disability for the age period one to fifteen years and for all ages beyond fifteen years.

For fractures of the entire femur (including all regions) the time of disability in non-operative cases in the period one to fifteen years is four and one-half months; for all other ages it is eight and one-fifth months. The operative cases show a little longer time of disability, namely, nine months, for adult cases.

For compound fractures of all regions of the femur the average period of disability is eleven months.

TABULATED REPORT ON FRACTURES OF THE FEMUR

TABLE I.—SUMMARY OF ALL CASES

	Total.	Non-operative.	Operative.
Femur, neck	100	93	7
Femur, trochanter	19	15	4
Femur, shaft	457	335	122
Femur, condyles	8	4	4
	584	447	137

TABLE II

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
Good	274 (47%)	228 (83%)	41 (15%)	5 (2%)
Moderate	205 (35%)	101 (49%)	85 (42%)	19 (9%)
Bad	82 (14%)	17 (21%)	22 (26%)	43 (53%)
	561 (96%)	346 (61%)	148 (27%)	67 (12%)
Died	23 (4%)			
	584 (100%)			

TABLE III.—NON-OPERATIVE CASES

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
Good	180 (42%)	157 (87%)	18 (10%)	5 (3%)
Moderate	180 (42%)	97 (54%)	66 (36%)	17 (9%)
Bad	65 (15%)	14 (21%)	15 (23%)	36 (55%)
	425 (99%)	268 (62%)	99 (23%)	58 (13%)
Died	22 (4.9%)			
	447			

TABLE IV.—OPERATIVE CASES

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
Good	94 (69%)	73 (77%)	21 (23%)	0
Moderate	25 (18%)	8 (32%)	15 (60%)	2 (8%)
Bad	17 (12%)	3 (17%)	4 (24%)	10 (59%)
	136 (99%)	84 (61%)	40 (29%)	12 (10%)
Died	1 (0.6%)			
	137			

TABLE V.—INFLUENCE OF AGE ON THE FUNCTIONAL RESULT

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
TOTAL NON-OPERATIVE AND OPERATIVE CASES				
1 to 15 years:				
Good	35 (68%)	32 (91%)	3 (8%)	0
Moderate	14 (27%)	10 (71%)	4 (28%)	0
Bad	2 (3%)	2 (100%)	0	0
	51 (100%)	44 (86%)	7 (13%)	0
Deaths	0			
15 to 45 years:				
Good	15 (50%)	14 (93%)	1 (6%)	0
Moderate	14 (46%)	9 (64%)	4 (28%)	1 (7%)
Bad	1 (3%)	0	0	1 (100%)
	30 (99%)	23 (77%)	5 (16%)	2 (6%)
Deaths	0			
45 to 60 years:				
Good	6 (35%)	6 (100%)	0	0
Moderate	10 (58%)	4 (40%)	6 (60%)	0
Bad	1 (5%	0	0	1 (100%)
	17 (98%)	10 (58%)	6 (36%)	1 (6%)
Deaths[1]	5 (22%)			
	22			
Over 60 years:				
Good	2 (20%)	0	1 (50%)	1 (50%)
Moderate	5 (50%)	1 (20%)	4 (80%)	0
Bad	3 (30%)	0	0	3 (100%)
	10 (100%)	1 (10%)	5 (50%)	4 (40%)
Deaths[2]	18 (64%)			
	28			
All over 15 years:				
Good	23 (40%)	20 (87%)	2 (8%)	1 (4%)
Moderate	29 (50%)	14 (48%)	14 (48%)	1 (4%)
Bad	5 (8%)	0	0	5 (100%)
	57 (98%)	34 (59%)	16 (28%)	7 (12%)
Deaths	23 (28%)			
	80			

[1] 3 shock, 1 gangrene, 1 pneumonia. [2] Shock and sepsis.

TABLE VI.—INFLUENCE OF AGE ON NON-OPERATIVE TREATMENT

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
1 to 15 years:				
Good . . .	26 (66%)	24 (92%)	1 (3%)	1 (3%)
Moderate .	11 (28%)	9 (81%)	2 (18%)	0
Bad . . .	2 (5%)	2 (100%)	0	0
	39 (99%)	35 (90%)	3 (8%)	1 (2%)
Deaths . .	0			
15 to 45 years:				
Good . . .	11 (46%)	9 (81%)	2 (19%)	0
Moderate .	12 (50%)	11 (91%)	1 (8%)	0
Bad . . .	1 (4%)	0	0	1 (100%)
	24 (100%)	20 (83%)	3 (12%)	1 (4%)
Deaths . .	0			
45 to 60 years:				
Good . .	5 (33%)	5 (100%)	0	0
Moderate .	9 (60%)	5 (55%)	4 (44%)	0
Bad . . .	1 (6%)	0	0	1 (100%)
	15 (99%)	10 (66%)	4 (26%)	1 (6%)
Deaths . .	4 (21%)			
	19			
Over 60 years:				
Good . . .	2 (25%)	0	1 (50%)	1 (50%)
Moderate .	4 (50%)	1 (25%)	3 (75%)	0
Bad . . .	2 (25%)	0	0	2 (100%)
	8 (100%)	1 (12%)	4 (50%)	3 (38%)
Deaths . .	18 (69%)			
	26			
All over 15 years:				
Good . . .	18 (38%)	14 (78%)	3 (16%)	1 (6%)
Moderate .	25 (53%)	17 (68%)	8 (32%)	0
Bad . . .	4 (8%)	0	0	4 (100%)
	47 (99%)	31 (65%)	11 (23%)	5 (10%)
Deaths . .	22 (31%)			
	69			

TABLE VII.—INFLUENCE OF AGE ON OPERATIVE TREATMENT

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
1 to 15 years:				
Good . . .	9 (75%)	8 (90%)	1 (10%)	0
Moderate .	3 (25%)	1 (33%)	2 (66%)	0
Bad . . .	0	0	0	0
	12 (100%)	9 (75%)	3 (25%)	0
Deaths . .	0			
15 to 45 years:				
Good . .	4 (66%)	4 (100%)	0	0
Moderate .	2 (33%)	0	2 (100%)	0
Bad . . .	0	0	0	0
	6 (99%)	4 (66%)	2 (33%)	
Deaths . .	0			
45 to 60 years:				
Good . .	1 (50%)	1 (100%)	0	0
Moderate .	1 (50%)	0	1 (100%)	0
Bad . . .	0	0	0	0
	2 (100%)	1 (50%)	1 (50%)	0
Deaths (sepsis)	1 (33%)			
	3			
Over 60 years:				
Good . . .	0	0	0	0
Moderate .	1 (50%)	0	1 (100%)	0
Bad . . .	1 (50%)	0	0	1 (100%)
	2 (100%)	0	1 (50%)	1 (50%)
Deaths . .	0			
All over 15 years:				
Good . .	5 (40%)	5 (100%)	0	0
Moderate .	4 (50%)	0	4 (100%)	0
Bad . . .	1 (10%)	0	0	1 (100%)
	10 (100%)	5 (50%)	4 (40%)	1 (10%)
Deaths, sepsis	1 (9%)			
	11			

TABLE VIII.—SUMMARY OF FRACTURES OF THE SHAFT OF THE FEMUR, INCLUDING ALL REGIONS

Anatomical result.	Total.	Good.	Functional result. Moderate.	Bad.
		NON-OPERATIVE		
Good . . .	152 (46%)	138 (90%)	13 (8%)	1 (0.2%)
Moderate . .	129 (38%)	82 (63%)	42 (33%)	5 (4%)
Bad	51 (16%)	14 (27%)	13 (25%)	24 (48%)
	332 (100%)	234 (70%)	68 (20%)	30 (10%)
		OPERATIVE		
Good . . .	84 (69%)	69 (82%)	15 (18%)	0
Moderate . .	21 (17%)	10 (48%)	9 (43%)	2 (9%)
Bad	16 (14%)	3 (19%)	3 (19%)	10 (62%)
	121 (100%)	82 (67%)	27 (22%)	12 (10%)
		ALL CASES		
Good . . .	236 (52%)	207 (87%)	28 (11%)	1 (0.2%)
Moderate . .	150 (34%)	92 (61%)	51 (34%)	7 (5%)
Bad	67 (14%)	17 (25%)	16 (24%)	34 (50%)
	453 (100%)	316 (69%)	95 (20%)	42 (10%)

Deaths: Non-operative, 3 (1 sepsis, 1 gangrene, 1 decubitus and sepsis). Operative, 1 (sepsis).

TABLE IX.—SUMMARY OF FRACTURES OF THE NECK OF THE FEMUR

Anatomical result.	Total.	Good.	Functional result. Moderate.	Bad.
		NON-OPERATIVE		
Good . . .	23 (28%)	14 (60%)	6 (26%)	3 (14%)
Moderate . .	44 (54%)	9 (20%)	25 (57%)	10 (23%)
Bad	14 (18%)	2 (14%)	9 (64%)	3 (22%)
	81 (100%)	25 (30%)	40 (50%)	16 (19%)
		OPERATIVE		
Good . . .	5 (71%)	2 (40%)	3 (60%)	0
Moderate . .	2 (29%)	0	2 (100%)	0
Bad	0	0	0	0
	7 (100%)	2 (29%)	5 (71%)	0
		ALL CASES		
Good . . .	28 (52%)	16 (57%)	9 (33%)	3 (10%)
Moderate . .	46 (32%)	9 (19%)	27 (58%)	10 (23%)
Bad	14 (16%)	2 (14%)	9 (64%)	3 (22%)
	88 (100%)	27 (30%)	45 (51%)	16 (19%)

Deaths: Non-operative, 12 (shock and old age). Deaths: Operative, 0.

TABLE X.—SHOWING COMPARISON BETWEEN NON-OPERATIVE AND OPERATIVE CASES

Anatomical result.		Functional result.							
		Total.		Good.		Moderate.		Bad.	
		Non-operative.	Operative.	Non-operative.	Operative.	Non-operative.	Operative.	Non-operative.	Operative.
Neck	Good	23	5	14	2	6	3	3	0
	Moderate	44	2	9	0	25	2	10	0
	Bad	14	0	2	0	9	0	3	0
	Died	12							
	Total	93	7	25	2	40	5	16	0
	Per cent.	100	100	30	28	50	71	19	0
Trochanters	Good	4	1	3	1	0	0	1	0
	Moderate	4	2	1	0	2	2	1	0
	Bad	0	1	0	0	0	1	0	0
	Died	7							
	Total	15	4	4	1	2	3	2	0
	Per cent.	100	100	50	25	25	75	25	0
Shaft	Good	152	84	138	69	13	15	1	0
	Moderate	129	21	82	10	42	9	5	2
	Bad	51	16	14	3	13	3	24	10
	Died	3	1						
	Total	335	122	234	82	68	27	30	12
	Per cent.	100	100	70	67	20	22	9	9
Condyles	Good	1	4	1	1	0	3	0	0
	Moderate	3	0	2	0	0	0	1	0
	Bad	0	0	0	0	0	0	0	0
	Total	4	4	3	1	0	3	1	0
	Per cent.	100	100	75	25	0	75	25	0
Entire Femur	Grand total	425	136	266	86	110	38	49	12
	Deaths	22	1						
	Per cent.	100	100	62	63	24	28	11	8

Table XI shows that 37 per cent. of the good anatomical results, 27 per cent. of the moderate anatomical results and 19 per cent. of the bad anatomical results have a disability of less

than six months. It is evident, therefore, that good anatomical results very markedly lessen the period of disability.

TABLE XI.—DOES GOOD ANATOMICAL RESULT LESSEN THE PERIOD OF DISABILITY?

	Anatomical result.	Total.	Period of disability.				
			Under 3 months.	Under 6 months.	Under 9 months.	Under 12 months.	Over 12 months.
Femur (all regions)	Good	178 (50%)	82 (46%)	51 (28%)	9 (6%)	28 (15%)	8 (5%)
	Moderate	122 (34%)	32 (25%)	36 (30%)	17 (14%)	17 (14%)	20 (16%)
	Bad	55 (16%)	9 (16%)	12 (22%)	4 (7%)	3 (6%)	27 (49%)
		355 (100%)	123 (35%)	99 (27%)	30 (8%)	48 (14%)	55 (16%)

Average period of disability for adults, 8.2 months.
Average period of disability for children under fifteen years, 4.5 months.

TABLE XII.—FEMUR, NECK

	Anatomical results.	Total.	Period of disability and functional results.														
			Under 3 months.			Under 6 months.			Under 9 months.			Under 12 months.			Over 12 months.		
			Good.	Mod.	Bad.	Good.	Mod.	Bad.	Good.	Mod.	Bad.	Good.	Mod.	Bad.	Good.	Mod.	Bad.
1 to 15 years	Good	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Moderate	2	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1
	Bad	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15 to 45 years	Good	4	1	0	0	1	0	0	0	0	0	1	1	0	0	0	0
	Good	7	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1
	Bad	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
45 to 60 years	Good	7	2	0	0	1	0	0	1	0	0	0	2	0	0	1	0
	Moderate	13	3	0	0	0	1	0	0	1	0	1	1	0	0	4	2
	Bad	5	0	0	0	0	0	0	0	0	1	0	0	0	0	0	4
Over 60 years	Good	7	0	1	0	2	1	0	0	0	0	0	0	0	0	1	2
	Moderate	15	0	0	0	0	6	1	0	1	0	0	3	0	0	2	2
	Bad	5	0	0	0	0	1	1	0	0	0	0	0	0	0	0	3
All ages	Good	22	7	1	0	4	1	0	1	0	0	1	3	0	0	2	2
	Moderate	37	3	4	1	2	7	1	0	2	0	1	4	1	0	6	5
	Bad	11	0	0	0	0	1	1	0	0	1	0	0	0	0	0	8

TABLE XIII.—FEMUR, SHAFT

	Anatomical result.	Total.	Period of disability and functional result.													
			Under 3 months.			Under 6 months.			Under 9 months.			Under 12 months.			Over 12 months.		
			Good.	Mod.	Bad.	Good.	Mod.	Bad.	Good.	Mod.	Bad.	Good.	Mod.	Bad.	Good.	Mod.	Bad.
1 to 15 years	Good	89	54	2	0	12	3	0	3	0	0	13	0	0	2	0	0
	Moderate	28	14	4	0	6	0	0	0	0	0	3	0	0	0	1	0
	Bad	10	4	0	4	0	0	1	0	0	0	0	0	0	1	0	0
15 to 45 years	Good	47	9	0	0	19	3	0	3	1	0	10	0	0	1	1	0
	Moderate	37	3	0	0	11	2	0	9	4	1	1	6	0	0	0	0
	Bad	15	0	0	0	5	0	0	3	0	0	0	2	0	1	1	3
45 to 60 years	Good	15	6	0	0	5	0	0	1	0	0	1	1	0	0	1	0
	Moderate	14	0	0	0	4	4	0	0	0	0	2	0	0	0	2	2
	Bad	10	1	0	0	1	2	0	0	0	0	0	0	0	0	0	6
Over 60 years	Good	4	0	0	0	2	0	0	0	0	0	1	0	0	0	1	0
	Moderate	7	1	0	0	1	0	0	0	0	0	1	1	0	0	2	1
	Bad	9	0	0	0	0	0	1	0	0	0	0	1	0	0	1	6
All ages	Good	155	69	2	0	38	6	0	7	1	0	25	1	0	3	3	0
	Moderate	86	18	4	0	22	6	0	9	4	1	7	7	0	0	5	3
	Bad	44	5	0	4	6	2	2	3	0	0	0	3	0	2	2	15

Average period of disability for adult cases, 8.2 months.
Average period of disability for children one to fifteen years, 4.5 months.

TABLE XIV.—FEMUR, SHAFT. OPERATIVE COMPARED WITH NON-OPERATIVE TREATMENT

Age.	Number of cases.		Period of disability.				
			Under 3 mos.	Under 6 mos.	Under 9 mos.	Under 12 mos.	Over 12 mos.
1 to 15 years	127	Non-operative . . 99 (78%)	66 (67%)	16 (16%)	0	16 (16%)	1 (1%)
		Operative . . . . 28(22%)	17 (62%)	4 (14%)	3 (10%)	1 (4%)	3 (10%)
15 to 45 years	99	Non-operative . . 66 (67%)	6 (9%)	24 (37%)	16 (24%)	16 (24%)	4 (6%)
		Operative 33 (33%)	6 (18%)	16 (48%)	5 (15%)	4 (13%)	2 (6%)
45 to 60 years	39	Non-operative . . 31 (79%)	7 (23%)	10 (30%)	4 (13%)	3 (11%)	7 (23%)
		Operative 8 (21%)	2 (25%)	1 (12%)	0	1 (12%)	4 (50%)
Over 60 years	20	Non-operative . . 16 (80%)	1 (7%)	1 (7%)	0	3 (18%)	11 (68%)
		Operative 4 (20%)	0	3 (75%)	0	1 (25%)	0
All ages	285	Non-operative . . 212 (75%)	80 (38%)	51 (24%)	20 (9%)	38 (18%)	23 (10%)
		Operative 73 (25%)	25 (35%)	24 (33%)	8 (11%)	7 (9%)	9 (12%)

Deaths: Non-operative, 4; operative, 0.
Average period of disability for non-operative adult cases, 8.2 months.
Average period of disability for operative adult cases, 9.0 months.

TABLE XV.—INFLUENCE ON RESULT OF TIME ELAPSING BETWEEN INJURY AND OPERATION (FEMUR)

Ages, years.			Date of operation, days.				Anatomical position.	Functional result.		
1 to 15	15 to 45	45 and over.	0 to 7	8 to 14	15 to 21	22 to 28		Good.	Mod.	Bad.
48	..	..	17	..	..	..	Good . . . 16	16		
							Moderate . 1	..	1	
							Bad . . . 0	..	..	0
				16	..	..	Good . . . 15	15		
							Moderate . 1	..	1	
							Bad . . . 0	..	..	0
					7	..	Good . . . 7	7		
							Moderate . 0	..	0	
							Bad . . . 0	..	..	0
						8	Good . . . 0	0		
							Moderate . 8	..	8	
							Bad . . . 0	..	..	0
	50	..	..	18	..	..	Good . . . 17	17		
							Moderate . 1	..	1	
							Bad . . . 0	..	..	0
					3	..	Good . . . 2	2		
							Moderate . 1	..	1	
							Bad . . . 0	..	..	0
						29	Good . . . 1	1		
							Moderate . 26	..	26	
							Bad . . . 2	..	..	2
		27	..	11	..	..	Good . . . 5	5		
							Moderate . 16	..	6	
							Bad . . . 0	..	..	0
						16	Good . . . 0	0		
							Moderate . 12	..	12	
							Bad . . . 4	..	..	4
125 cases			..	17	45	10	53	Good . . . 63	63		
							Moderate . 56	..	56	
							Bad . . . 6	..	..	6

TABLE XVI.—SUMMARY OF SIMPLE FRACTURES OF THE FEMUR IN THE SEVERAL REGIONS

Femur.	Number of cases.	Non-operative.	Operative.
Neck	31	30	1
Upper third	18	13	5
Middle third	61	47	14
Lower third	14	11	3
Through trochanter	7	7	0
	131	108	23
Deaths—Neck	12	12	0
Upper third	2	1	1
Middle third	2	2	0
Lower third	0	0	0
Through trochanter	7	7	0
	23	22	1

Tables XVI to XXIV are the result of a study of 131 fractures of the femur to show the number of cases and comparative results of non-operative and operative treatment of fractures in the several regions of the femur. Non-operative cases, 108; operative cases, 23.

The middle third shows by far the largest number of cases. That the neck is fractured very rarely except in senile individuals the tables show conclusively.

Fractures of the femur are more frequent in the age period 1 to 15 years in all regions except the neck and trochanter.

In this series of cases, except in very old individuals, good anatomical results in cases of fracture, in all regions, were followed by 100 per cent. good functional results in non-operative cases except in the lower third.

The period of disability is a little less in non-operative cases. One must remember, however, that the operative method is used when the non-operative is not practicable or does not suffice to reduce or retain the fracture. Operative cases are therefore essentially more difficult cases and the condition for rapid union are not as good; however, the operation makes a

simple fracture a compound one. The trauma of the soft tissues, and especially the forcible manipulation of the fragments, undoubtedly retards bony union.

Except two the deaths all occurred in senile cases and from fractures of the upper segments of the bone. This emphasizes the fact that fractures of the femur anywhere above the middle third are very serious injuries for aged patients.

TABLE XVII.—COMPARATIVE RESULTS OF OPERATIVE AND NON-OPERATIVE TREATMENT OF SIMPLE FRACTURES OF THE FEMUR IN THE SEVERAL REGIONS

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
NECK:		NON-OPERATIVE		
Good	7 (23%)	4 (57%)	2 (28%)	1 (14%)
Moderate	8 (26%)	4 (50%)	4 (50%)	0
Bad	3 (10%)	0	0	3 (100%)
Deaths	12 (40%)			
	30 (99%)	8 (50%)	6 (25%)	4 (23%)
NECK:		OPERATIVE		
Good	0	0	1 (100%)	0
Moderate	1 (100%)	0	0	0
Bad	0	0	0	0
Deaths	0			
	1 (100%)	0	1 (100%)	0

TABLE XVIII

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
UPPER THIRD:		NON-OPERATIVE		
Good	6 (46%)	5 (82%)	1 (17%)	0
Moderate	6 (46%)	5 (82%)	1 (17%)	0
Bad	0	0	0	0
Deaths	1 (8%)			
	13 (100%)	10 (83%)	2 (16%)	0
UPPER THIRD:		OPERATIVE		
Good	3 (60%)	2 (66%)	1 (33%)	0
Moderate	1 (20%)	1 (100%)	0	0
Bad	0	0	0	0
Deaths	1 (20%)			
	5 (100%)	3 (75%)	1 (25%)	0

TABLE XIX

Anatomical result.	Total.	Good.	Functional result. Moderate.	Bad.
MIDDLE THIRD:		NON-OPERATIVE		
Good . . .	25 (53%)	25 (100%)	0	0
Moderate .	18 (38%)	12 (66%)	5 (27%)	1 (6%)
Bad . . .	2 (4%)	2 (100%)	0	0
Deaths . .	2 (4%)			
	47 (99%)	39 (86%)	5 (12%)	1 (25%)
MIDDLE THIRD:		OPERATIVE		
Good . .	9 (64%)	9 (100%)	0	0
Moderate .	5 (35%)	2 (40%)	3 (60%)	0
Bad . . .	0	0	0	0
Deaths . .	0			
	14 (99%)	11 (78%)	3 (22%)	0

TABLE XX

Anatomical result.	Total.	Good.	Functional result. Moderate.	Bad.
LOWER THIRD:		NON-OPERATIVE		
Good . .	6 (54%)	5 (82%)	1 (17%)	0
Moderate .	4 (36%)	3 (75%)	1 (25%)	0
Bad . . .	1 (10%)	0	0	1 (100%)
Deaths . .	0			
	11 (100%)	8 (72%)	2 (18%)	1 (9%)
LOWER THIRD:		OPERATIVE		
Good . .	2 (66%)	2 (100%)	0	0
Moderate .	0	0	0	0
Bad . . .	1 (33%)	0	0	1 (100%)
Deaths . .	0			
	3 (99%)	2 (66%)	0	1 (33%)

TABLE XXI.—INFLUENCE OF AGE PERIOD IN THE DIFFERENT REGIONS

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
NECK:		NON-OPERATIVE		
1 to 15 years:				
Good . .	0	0	0	0
Moderate .	1 (100%)	1 (100%)	0	0
Deaths .	0	0	0	0
	1 (100%)	1 (100%)	0	0
NECK:		NON-OPERATIVE		
15 to 45 years:				
Good . .	2 (100%)	2 (100%)	0	0
Moderate .	0	0	0	0
Bad . .	0	0	0	0
Deaths .	0			
	2 (100%)	2 (100%)	0	0
NECK:		OPERATIVE		
15 to 45 years: No cases reported.				
NECK:		NON-OPERATIVE		
45 to 60 years:				
Good . .	3 (30%)	3 (100%)	0	0
Moderate .	4 (40%)	2 (80%)	2 (50%)	0
Bad . .	1 (10%)	0	0	1 (100%)
Deaths .	2 (20%)	0	0	0
	10 (100%)	5 (63%)	2 (25%)	1 (12%)
Deaths: 2 pneumonia.				
NECK:		OPERATIVE		
45 to 60 years:				
Good . .	0	0	0	0
Moderate .	1 (100%)	0	1 (100%)	0
Bad . .	0	0	0	0
Deaths .	0			
	1 (100%)	0	1 (100%)	0
NECK:		NON-OPERATIVE		
Over 60 years:				
Good . .	2 (12%)	0	1 (50%)	1 (50%)
Moderate .	3 (17%)	0	3 (100%)	0
Bad . .	2 (12%)	0	0	2 (100%)
Deaths[1] .	10 (58%)			
	17 (99%)	0	4 (56%)	3 (43%)
NECK:		OPERATIVE		
Over 60 years: No cases reported.				

[1] Deaths from old age and shock.

TABLE XXII.

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
		NON-OPERATIVE		
UPPER THIRD:				
1 to 15 years:				
Good . .	5 (71%)	5 (100%)	0	0
Moderate .	2 (28%)	1 (50%)	1 (50%)	0
Bad . .	0	0	0	0
Deaths .	0			
	7 (99%)	6 (85%)	1 (14%)	0

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
		OPERATIVE		
UPPER THIRD:				
1 to 15 years:				
Good . .	0	0	0	0
Moderate .	1 (100%)	0	1 (100%)	0
Bad . .	0	0	0	0
Deaths .	0			
	1 (100%)	0	1 (100%)	0
		NON-OPERATIVE		
UPPER THIRD:				
15 to 45 years:				
Good . .	1 (33%)	1 (100%)	0	0
Moderate .	2 (66%)	2 (100%)	0	0
Bad . .	0	0	0	0
Deaths .	0			
	3 (99%)	3 (100%)	0	0
		OPERATIVE		
UPPER THIRD:				
15 to 45 years:				
Good . .	2 (100%)	2 (100%)	0	0
Moderate .	0	0	0	0
Bad . .	0	0	0	0
Deaths .	0			
	2 (100%)	2 (100%)	0	0

NON-OPERATIVE

UPPER THIRD:				
45 to 60 years:				
Good . .	0	0	0	0
Moderate .	1 (50%)	1 (100%)	0	0
Bad . .	0	0	0	0
Deaths[1] .	1 (50%)			
	2 (100%)	1 (100%)	0	0

OPERATIVE

UPPER THIRD:				
45 to 60 years:				
Good . .	1 (100%)	1 (100%)	0	0
Moderate .	0	0	0	0
Bad . .	0	0	0	0
Deaths .	0			
	1 (100%)	1 (100%)	0	0

NON-OPERATIVE

UPPER THIRD:				
Over 60 years:				
Good . .	0	0	0	0
Moderate .	1 (50%)	1 (100%)	0	0
Bad . .	0	0	0	0
Deaths[2] .	1			
	1 (50%)	1 (100%)	0	0

OPERATIVE

UPPER THIRD:
Over 60 years: No cases reported.

[1] Sepsis, 1. [2] Diabetes.

TABLE XXIII

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
		NON-OPERATIVE		
MIDDLE THIRD:				
1 to 15 years:				
Good . .	19 (61%)	19 (100%)	0	0
Moderate .	8 (26%)	5 (51%)	3 (38%)	0
Bad . .	2 (6%)	2 (100%)	0	0
Deaths[1] .	2 (6%)			
	31 (99%)	26 (89%)	3 (11%)	0
		OPERATIVE		
MIDDLE THIRD:				
1 to 15 years:				
Good . .	8 (60%)	8 (100%)	0	0
Moderate .	2 (40%)	1 (50%)	1 (50%)	0
Bad . .	0	0	0	0
Deaths .	0			
	10 (100%)	9 (90%)	1 (10%)	0
		NON-OPERATIVE		
MIDDLE THIRD:				
15 to 45 years:				
Good . .	5 (38%)	5 (100%)	0	0
Moderate .	8 (61%)	5 (62%)	2 (25%)	1 (13%)
Bad . .	0	0	0	0
Deaths .	0			
	13 (99%)	10 (76%)	2 (15%)	1 (8%)
		OPERATIVE		
MIDDLE THIRD:				
15 to 45 years:				
Good . .	1 (20%)	1 (100%)	0	0
Moderate .	2 (40%)	0	2 (100%)	0
Bad . .	0	0	0	0
Deaths[1] .	2 (40%)			
	5 (100%)	1 (33%)	2 (66%)	0

[1] 1 gangrene, 1 sepsis.

[1] 1 gangrene, 1 shock.

NON-OPERATIVE

MIDDLE THIRD:				
45 to 60 years:				
Good . .	1 (20%)	1 (100%)	0	0
Moderate .	2 (40%)	0	2 (100%)	0
Bad . .	0	0	0	0
Deaths[1] .	2 (40%)			
	5 (100%)	1 (33%)	2 (66%)	0

OPERATIVE

MIDDLE THIRD:				
45 to 60 years:				
Good . .	0	0	0	0
Moderate .	0	0	0	0
Bad . .	0	0	0	0
Deaths .	0	0	0	0
	0	0	0	0

NON-OPERATIVE

MIDDLE THIRD:
Over 60 years: No cases reported.

OPERATIVE

MIDDLE THIRD:				
Over 60 years:				
Good . .	0	0	0	0
Moderate .	1 (100%)	0	1 (100%)	0
Bad . .	0	0	0	0
	1 (100%)	0	1 (100%)	0

TABLE XXIV

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
		NON-OPERATIVE		
LOWER THIRD:				
1 to 15 years:				
Good . .	2 (100%)	1 (50%)	1 (50%)	0
Moderate .	0	0	0	0
Bad . .	0	0	0	0
Deaths .	0			
	2 (100%)	1 (50%)	1 (50%)	0
		OPERATIVE		
LOWER THIRD:				
1 to 15 years:				
Good . .	1 (100%)	1 (100%)	0	0
Moderate .	0	0	0	0
Bad . .	0	0	0	0
Deaths .	0			
	1 (100%)	1 (100%)	0	0
		NON-OPERATIVE		
LOWER THIRD:				
15 to 45 years:				
Good . .	3 (50%)	3 (100%)	0	0
Moderate .	2 (33%)	1 (50%)	1 (50%)	0
Bad . .	1 (17%)	0	0	1 (100%)
Deaths .	0	0	0	0
	6 (100%)	4 (66%)	1 (16%)	1 (16%)
		OPERATIVE		
LOWER THIRD:				
15 to 45 years:				
Good . .	1 (100%)	1 (100%)	0	0
Moderate .	0	0	0	0
Bad . .	0	0	0	0
Deaths .	0			
	1 (100%)	1 (100%)	0	0

NON-OPERATIVE

LOWER THIRD:				
45 to 60 years:				
Good . .	1 (33%)	1 (100%)	0	0
Moderate .	2 (66%)	1 (50%)	1 (50%)	0
Bad . .	0	0	0	0
Deaths .	0	0	0	0
	3 (99%)	2 (66%)	1 (33%)	0

OPERATIVE

LOWER THIRD:
45 to 60 years: No cases reported.

TABLE XXV

Anatomica result.	Total.	Functional result. Good.	Moderate.	Bad.
NON-OPERATIVE				
LOWER THIRD:				
Over 60 years: No cases reported.				
OPERATIVE				
LOWER THIRD:				
Over 60 years:				
Good . .	0	0	0	0
Moderate .	0	0	0	0
Bad . .	1 (100%)	1 (100%)	0	0
Deaths .	0	0	0	0
	1 (100%)	1 (100%)	0	0

TIME ELAPSING BETWEEN INJURY AND EFFICIENT TREATMENT. In a series of 248 cases of fracture of the femur, 107 were treated within the first twelve hours; 31 between thirteen and twenty-four hours; 20 between twenty-five and forty-eight hours; 14 between forty-nine and seventy-two hours; 13 after seventy-three hours. In 63 cases the time was not stated.

From a collection of 165 cases of fracture of the femur which were operated on it was possible to analyze more or less accurately a series of 125 cases and thus learn whether or not prompt attention markedly affected their results: 48 were children up to fifteen years; 17 were operated on within seven days, 16

secured normal function and 1 moderate function; 16 were operated on within fourteen days, 15 secured normal function and 1 moderate function; 7 were operated on within twenty-one days and secured normal function; 8 were operated on after twenty-eight days and secured moderate function. Of the whole 48 patients the results were 80 per cent. good function and 20 per cent. moderate function.

There were 50 cases between fifteen and forty-five years: 18 were operated on within fourteen days, 17 secured normal function and 1 moderate function; 3 were operated on within twenty-one days, 2 secured normal function and 1 moderate function; whereas 29 were operated on later and secured only normal function in 1, 26 moderate, and 2 bad function. Of the whole number, 50 patients, 40 per cent. secured normal function, 56 per cent. secured moderate function, and 4 per cent. secured bad function.

There were 27 cases over forty-five years of age: 5 only secured normal function and all were operated on within fourteen days; 6 additional cases operated on within fourteen days secured only moderate function; whereas 16 cases were operated on later than fourteen days and secured only moderate function in 12 cases and bad function in 4 cases. Of the whole number, 27 patients, 18 per cent. secured normal function, 67 per cent. moderate function, and 15 per cent. bad function.

TABLE XXVI.—SUMMARY OF ALL CASES OF COMPOUND FRACTURES OF THE FEMUR

Anatomical result.	Total.	Non-operative.	Operative.
Neck	1	1	0
Upper third	10	6	4
Middle third	20	7	13
Lower third	39	10	29
	70	24	46

TABLE XXVII

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
Good . . .	42 (66%)	38 (90%)	4 (10%)	0
Moderate . .	10 (16%)	7 (70%)	3 (30%)	0
Bad	11 (18%)	0	9 (82%)	2 (18%)
	63 (100%)	45 (71%)	16 (25%)	2 (4%)
Deaths . . .	7			
	70			

TABLE XXVIII

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
	NON-OPERATIVE			
Good . . .	16 (76%)	15 (93%)	1 (7%)	0
Moderate . .	4 (20%)	2 (50%)	2 (50%)	0
Bad	1 (4%)	0	0	1 (100%)
	21	17 (81%)	3 (14%)	1 (5%)
Deaths . . .	3			
	24			

TABLE XXIX

Anatomical result	Total..	Functional result. Good.	Moderate.	Bad.
	OPERATIVE			
Good . . .	26 (62%)	25 (97%)	1 (3%)	0
Moderate . .	6 (14%)	5 (83%)	1 (17%)	0
Bad	10 (24%)	0	2 (20%)	8 (80%)
	42 (100%)	30 (73%)	4 (9%)	8 (18%)
Deaths . . .	4			
	46			

TABLE XXX.—INFLUENCE OF AGE ON THE FUNCTIONAL RESULT

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
1 to 15 years:				
Good . .	8 (66%)	8 (100%)	0	0
Moderate .	1 (8%)	1 (100%)	0	0
Bad . . .	3 (25%)	0	3 (100%)	0
	12 (99%)	9 (75%)	3 (25%)	0
Deaths, 3 (shock).				
15 to 45 years:				
Good . .	32 (73%)	31 (97%)	1 (3%)	0
Moderate .	8 (18%)	5 (62%)	2 (25%)	1 (13%)
Bad . . .	4 (9%)	0	0	4 (100%)
	44 (100%)	36 (82%)	3 (7%)	5 (11%)
Deaths, 1 (loss of blood).				
45 to 60 years:				
Good . .	2 (33%)	2 (100%)	0	0
Moderate .	1 (16%)	0	1 (100%)	0
Bad . . .	3 (50%)	0	1 (33%)	2 (66%)
	6 (99%)	2 (33%)	2 (33%)	2 (66%)
Deaths, 2 (shock).				
Over 60 years:				
Good . .	1 (100%)	1 (100%)	0	0
Moderatef .	0	0	0	0
Bad . . .	0	0	0	0
	1 (100%)	1 (100%)	0	0
Deaths, 1 (shock).				

Total deaths, 7 (6 shock, 1 loss of blood).

TABLE XXXI.—INFLUENCE OF AGE ON NON-OPERATIVE TREATMENT

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
1 to 15 years:				
Good . .	2 (66%)	2 (100%)	0	0
Moderate .	1 (33%)	1 (100%)	0	0
Bad . . .	0	0	0	0
	3 (90%)	3 (100%)	0	0
Deaths, 2 (shock).				

15 to 45 years:				
Good . .	11 (78%)	11 (100%)	0	0
Moderate .	3 (22%)	0	2 (66%)	1 (33%)
Bad . . .	0	0	0	0
	14 (100%)	11 (78%)	2 (14%)	1 (8%)
45 to 60 years:				
Good . .	2 (66%)	2 (100%)	0	0
Moderate .	0	0	0	0
Bad . . .	1 (33%)	0	0	1 (100%)
	3 (100%)	2 (66%)	0	1 (33%)
Over 60 years:				
Good . .	1 (100%)	1 (100%)	0	0
Moderate .	0	0	0	0
Bad . . .	0	0	0	0
	1 (100%)	1 (100%)	0	0

Deaths, 1 (shock). Total deaths, 3 (shock).

TABLE XXXII.—INFLUENCE OF AGE ON OPERATIVE TREATMENT

Anatomical result.	Total.	Functional result. Good.	Moderate.	Bad.
1 to 15 years:				
Good . .	6 (66%)	6 (100%)	0	0
Moderate .	0	0	0	0
Bad . . .	3 (33%)	0	3 (100%)	0
	9 (99%)	6 (66%)	3 (33%)	0

Deaths, 1 (shock).

15 to 45 years:				
Good . .	21 (70%)	20 (95%)	1 (5%)	0
Moderate .	5 (16%)	3 (60%)	2 (40%)	0
Bad . . .	4 (14%)	0	0	4 (100%)
	30 (100%)	23 (76%)	3 (10%)	4 (14%)

Deaths, 1 (loss of blood).

45 to 60 years:				
Good . .	0	0	0	0
Moderate .	1 (33%)	0	1 (100%)	0
Bad . . .	2 (66%)	0	1 (50%)	1 (50%)
	3 (99%)	0	2 (66%)	1 (33%)

Deaths, 2 (shock).

Over 60 years: No cases reported. Total deaths, 4 (3 shock, 1 loss of blood.)

TABLE XXXIII.—COMPOUND FRACTURES OF THE FEMUR (SHAFT)

Anatomical result.	Total.	Good.	Functional result. Moderate.	Bad.
		NON-OPERATIVE		
Good . . .	15 (75%)	15 (100%)	0	0
Moderate . .	4 (20%)	2 (50%)	2 (50%)	0
Bad	1 (5%)	0	0	1 (10%)
	20 (100%)	17 (85%)	2 (10%)	1 (5%)
Deaths, 3				
		OPERATIVE		
Good . . .	26 (62%)	25 (97%)	1 (3%)	0
Moderate . .	6 (14%)	5 (83%)	1 (17%)	0
Bad	10 (24%)	0	2 (20%)	8 (80%)
	42 (100%)	30 (73%)	4 (9%)	8 (18%)
Deaths, 4.				

TABLE XXXIV.—COMPOUND FRACTURES OF THE FEMUR (NECK)

Anatomical result.	Total.	Good.	Functional result. Moderate.	Bad.
		NON-OPERATIVE		
Good . . .	1 (100%)	1 (100%)	0	0
Moderate . .	0	0	0	0
Bad	0	0	0	0
	1 (100%)	1 (100%)	0	0
		OPERATIVE		

No cases reported.

TABLE XXXV.—DOES GOOD ANATOMICAL RESULT LESSEN THE PERIOD OF DISABILITY

COMPOUND FRACTURES OF THE FEMUR

Anatomical result.	Total.	Period of disability.				
		Under 3 mos.	Under 6 mos.	Under 9 mos.	Under 12 mos.	Over 12 mos.
FEMUR (all forms):						
Good . . .	3 (25%)	1 (33%)	1 (33%)	1 (33%)	0	0
Moderate . .	7 (58%)	0	2 (28%)	4 (57%)	0	1 (15%)
Bad	2 (17%)	0	0	1 (50%)	0	1 (50%)
	12 (100%)	1 (8%)	3 (25%)	6 (50%)	0	2 (16%)

NOTE.—Table XXXV represents the only cases reported the last year with periods of disability noted. These combined with those of the 1915 report, namely, 51 cases, would give 63 cases, an average disability of 11.5 months. The one case with a noted disability under three months was a child eight years of age. For adult cases, therefore, the average disability proves to be 11.8 months.

TABLE XXXVI—COMPOUND FRACTURES OF THE FEMUR, ALL FORMS

	Anatomical result.	Total.	Period of disability and functional result.														
			Under 3 months.			Under 6 months.			Under 9 months.			Under 12 months.			Over 12 months.		
			Good.	Mod.	Bad.	Good.	Mod.	Bad.	Good.	Mod.	Bad.	Good.	Mod.	Bad.	Good.	Mod.	Bad.
1 to 15 years	Good	1	1	0	0	0	0	0	0	0	0						
	Moderate	1	0	0	0	1	0	0	0	0	0						
	Bad	0	0	0	0	0	0	0	0	0	0						
15 to 45 years	Good	2	0	0	0	1	0	0	0	1	0						
	Moderate	5	0	0	0	1	0	0	3	1	0						
	Bad	1	0	0	0	0	0	0	0	0	1						
45 to 60 years	Good	0	0	0	0	0	0	0	0	0	0						
	Moderate	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	Bad	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Over 60 years	No cases.																

TABLE XXXVII.—OPERATIVE COMPARED WITH NON-OPERATIVE TREATMENT

COMPOUND FRACTURES OF THE FEMUR

Age.	Number of cases.	Period of disability.				
		Under 3 mos.	Under 6 mos.	Under 9 mos.	Under 12 mos.	Over 12 mos.
1 to 15 years	2 { Non-operative . . 1 (50%)	0	1 (100%)	0	0	0
	{ Operative 1 (50%)	1 (100%)	0	0	0	0
15 to 45 years	8 { Non-operative . . 3 (37%)	0	2 (66%)	1 (33%)	0	0
	{ Operative 5 (61%)	0	0	5 (100%)	0	
45 to 60 years	2 { Non-operative . . 0	0	0	0	0	0
	{ Operative 2 (100%)	0	0	0	0	2 (100%)
Over 60 years	No cases.					
All ages	12 { Non-operative . . 4 (33%)	0	3 (75%)	1 (25%)	0	0
	{ Operative 8 (66%)	1 (12%)	0	5 (61%)	0	2 (25%)

NOTE.—Table XXXVIII records only cases reported the last year and represents the latest after-the-war treatment. It is too small a number to have conclusive value, but is suggestive of what may be expected in regard to periods of disability. The two cases which went over twelve months had each of them twenty months' disability.

TABLE XXXVIII.—COMPARATIVE RESULTS OF OPERATIVE AND NON-OPERATIVE CASES

Compound Fractures of the Femur

Fracture.	Operative cases.			Non-operative cases.		
	Cases.	Good anatomical result.	Good functional result.	Cases.	Good. anatomical result.	Good functional result.
Femur Shaft	46	57%	65%	23	66%	69%

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